

NASA SP-7011 (349)

May 1991

# AEROSPACE MEDICINE AND BIOLOGY

(NASA-SP-7011(349)) AEROSPACE MEDICINE AND  
BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH  
INDEXES (SUPPLEMENT 349) (NASA) 50 p

CSSL 06E

N91-24731

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A CONTINUING BIBLIOGRAPHY WITH INDEXES

# **AEROSPACE MEDICINE AND BIOLOGY**

A CONTINUING BIBLIOGRAPHY WITH INDEXES

# INTRODUCTION

This issue of *Aerospace Medicine and Biology* (NASA SP-7011) lists 149 reports, articles and other documents originally announced in April 1991 in *Scientific and Technical Aerospace Reports (STAR)* or in *International Aerospace Abstracts (IAA)*. The first issue of *Aerospace Medicine and Biology* was published in July 1964.

Accession numbers cited in this issue are:

STAR (N-10000 Series)	N91-15123 — N91-16987
IAA (A-10000 Series)	A91-20489 — A91-24168

In its subject coverage, *Aerospace Medicine and Biology* concentrates on the biological, physiological, psychological, and environmental effects to which humans are subjected during and following simulated or actual flight in the Earth's atmosphere or in interplanetary space. References describing similar effects on biological organisms of lower order are also included. Such related topics as sanitary problems, pharmacology, toxicology, safety and survival, life support systems, exobiology, and personnel factors receive appropriate attention. Applied research receives the most emphasis, but references to fundamental studies and theoretical principles related to experimental development also qualify for inclusion.

Each entry in the publication consists of a standard bibliographic citation accompanied in most cases by an abstract. The listing of the entries is arranged by *STAR* categories 51 through 55, the Life Sciences division. The citations include the original accession numbers from the respective announcement journals.

Seven indexes—subject, personal author, corporate source, foreign technology, contract, report number, and accession number—are included.

A cumulative index for 1991 will be published in early 1992.

Information on availability of documents listed, addresses of organizations, and NTIS price schedules are located at the back of this issue.

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## TYPICAL REPORT CITATION AND ABSTRACT

**NASA SPONSORED**  
↓  
**ON MICROFICHE**

**ACCESSION NUMBER** → **N91-10591\*** # Good Samaritan Hospital and Medical Center, ← **CORPORATE SOURCE**  
Portland, OR. Neurological Sciences Inst.

**TITLE** → **ROLE OF ORIENTATION REFERENCE SELECTION IN**  
**MOTION SICKNESS Semiannual Status Report**

**AUTHORS AND** → **ROBERT J. PETERKA and F. OWEN BLACK** Sep. 1990 37 p

**PUBLICATION DATE** → (Contract NAG9-117)

**CONTRACT NUMBER** → (NASA-CR-186612; NAS 1.26:186612) Avail: NTIS HC/MF A03 ← **AVAILABILITY SOURCE**

**REPORT NUMBERS** → **COSATI CODE** → **CSCL 06E** ← **PRICE CODE**

Three areas related to human orientation control are investigated:  
(1) reflexes associated with the control of eye movements and posture;  
(2) the perception of body rotation and position with respect to gravity;  
and (3) the strategies used to resolve sensory conflict situations which  
arise when different sensory systems provide orientation cues which  
are not consistent with one another or with previous experience. Of  
particular interest is the possibility that a subject may be able to  
ignore an inaccurate sensory modality in favor of one or more other  
sensory modalities which do provide accurate orientation reference  
information. This process is referred as sensory selection. This  
proposal will attempt to quantify subject's sensory selection abilities  
and determine if this ability confers some immunity to the development  
of motion sickness symptoms.

Author

## TYPICAL JOURNAL ARTICLE CITATION AND ABSTRACT

**NASA SPONSORED**  
↓

**ACCESSION NUMBER** → **A91-12594\*** National Aeronautics and Space Administration. ← **CORPORATE SOURCE**  
Ames Research Center, Moffett Field, CA.

**TITLE** → **CREW SUPPORT FOR AN INITIAL MARS EXPEDITION**

**AUTHORS** → **YVONNE A. CLEARWATER** (NASA, Ames Research Center, ← **AUTHORS' AFFILIATION**  
Moffett Field, CA) and **ALBERT A. HARRISON** (California,  
University, Davis) British Interplanetary Society, Journal (ISSN  
0007-084X), vol. 43, Nov. 1990, p. 513-518. refs

Copyright → **JOURNAL TITLE**  
→ **PUBLICATION DATE**

Mars crews will undergo prolonged periods of isolation and  
confinement, travel unprecedented distances from earth and be  
subjected to formidable combinations of hardships and dangers.  
Some of the biomedical, psychological and social challenges of the  
first manned Mars expedition are reviewed and means of aligning  
humans, technology and space habitats in the interests of mission  
success are identified.

Author

# AEROSPACE MEDICINE AND BIOLOGY

*A Continuing Bibliography (Suppl. 349)*

MAY 1991

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## LIFE SCIENCES (GENERAL)

A91-20534

### BONE HISTOMORPHOMETRIC COMPARISON OF RAT TIBIAL METAPHYSIS AFTER 7-DAY TAIL SUSPENSION VS. 7-DAY SPACEFLIGHT

L. VICO, C. ALEXANDRE (Saint-Etienne, Universite, France), V. E. NOVIKOV (Institut Mediko-Biologicheskikh Problem, Moscow, USSR), and J. M. VERY (Centre Medical Universitaire, Geneva, Switzerland) *Aviation, Space, and Environmental Medicine* (ISSN 0095-6562), vol. 62, Jan. 1991, p. 26-31. Research supported by CNES and DRET. refs

Copyright

The applicability of the rat tail suspension model to studies of the effect of spaceflight on rat bone cells was investigated by comparing the histomorphometric effects of a 7-day spaceflight aboard Biocosmos 1667 on proximal tibial metaphysis of 12-13-old male rats with those of 7-day-long tail suspension. The rats were injected with demethylchlortetracycline on the first day of experiments to label the calcifying tissues. Results of macroscopic and microscopic examinations of the rat tibiae indicated that the mechanism of bone loss due to microgravity in space are not entirely identical to that due to tail suspension on earth. I.S.

A91-20535

### EPIDERMAL GROWTH FACTOR-INDUCED CELL ROUNDING IS SENSITIVE TO SIMULATED MICROGRAVITY

R. P. DE GROOT, W. KRUIJER, A. J. VERKLEIJ (Utrecht, Rijksuniversiteit, Netherlands), W. BRIEGLEB (DLR, Cologne, Federal Republic of Germany), P. J. RIJKEN et al. *Aviation, Space, and Environmental Medicine* (ISSN 0095-6562), vol. 62, Jan. 1991, p. 32-36. Research supported by SRON. refs

Copyright

Epidermal growth factor (EGF) induces rapid rounding of A431 human epidermoid carcinoma cells. This process is dependent upon temperature and EGF concentration. To investigate the possible influence of gravity variations on EGF-induced cell rounding of A431 cells, experiments were performed using a fast-rotating clinostat and centrifuge, thereby simulating microgravity and higher gravity values, respectively. It was demonstrated that simulated microgravity conditions enhance EGF-induced cell rounding significantly, whereas hypergravity values do not show significant effects on this process. These results suggest that simulated microgravity modulates growth factor-induced signal transduction. Author

A91-20536

### EPIDERMAL GROWTH FACTOR-INDUCED EXPRESSION OF C-FOS IS INFLUENCED BY ALTERED GRAVITY CONDITIONS

R. P. DE GROOT, J. BOONSTRA, A. J. VERKLEIJ, S. W. DE LAAT (Utrecht, Rijksuniversiteit, Netherlands), P. J. RIJKEN et al. *Aviation, Space, and Environmental Medicine* (ISSN 0095-6562), vol. 62, Jan. 1991, p. 37-40. Research supported by SRON. refs

Copyright

Epidermal growth factor (EGF) activates a well characterized signal transduction system in human A431 epidermoid carcinoma cells, which leads to rapid and transient expression of the c-fos proto-oncogene. In order to investigate the influence of altered gravity on EGF-induced signal transduction, the EGF-induced c-fos expression was studied under simulated hypo- and hypergravity conditions. In this report, it is shown that EGF-induced fos expression is decreased under simulated hypogravity conditions, while hypergravity has a stimulatory effect on EGF-induced fos expression. These results show that the EGF-activated signal transduction system is influenced by gravity, and that gravity exerts its effects already in the early phases of the signal transduction cascade. Author

ABSTRACTS

A91-20537

### INTROPIC AND CHRONOTROPIC EFFECTS OF ISOPRENALINE IN RATS EXPOSED TO 30 BAR

L. E. B. STUHR, J. A. ASK, and I. TYSSEBOTN (Bergen, Universitetet, Norway) *Aviation, Space, and Environmental Medicine* (ISSN 0095-6562), vol. 62, Jan. 1991, p. 41-45. Research supported by NAF. refs

Copyright

Intropic and chronotropic responses to the beta-agonist, isoprenaline (ISO) were studied with a transducer located in the left ventricle and a catheter placed in the left femoral artery in anesthetized rats at 1 and 30 bar. The hemodynamic control values were equal in both series. During ISO infusion, the chronotropy increased equally (34 percent) at 1 and 30 bar. The inotropy increased by 38 percent during ISO infusion at 1 bar. Increased inotropy (44 percent), and unchanged chronotropy were found during compression to 30 bar. The ISO evoked inotropic responses in absolute values were greater at 30 bar than at 1 bar. Nevertheless, an equal relative increase in inotropy was found during ISO infusion at 30 bar compared to 1 bar. The cardiac oxygen consumption was estimated to be 65 percent higher at 30 bar during ISO infusion compared to that at 1 bar. Author

A91-20558

### ALTERED BAROREFLEX FUNCTION AFTER TAIL SUSPENSION IN THE CONSCIOUS RAT

BARBARA L. BRIZZEE (Tulane University, New Orleans, LA) and BENJIMEN R. WALKER (New Mexico, University, Albuquerque) *Journal of Applied Physiology* (ISSN 0161-7567), vol. 69, Dec. 1990, p. 2091-2096. refs

(Contract NIH-HL-42778)

Copyright

The effect of simulated weightlessness on the baroreceptor reflex (BRR) sensitivity was investigated using chronically instrumented rats subjected to tail suspension (1 week of 30-deg head-down tilt). The BRR sensitivity was assessed by administration of a series of intravenous bolus doses of phenylephrine (0.50, 0.75, 1.25, 2.00, and 2.50 microgram/kg). In addition, the effect of intravenous administration of a specific antagonist to V2-vasopressinergic receptors, d(CH2)5(D-Ile2, Ile4)-arginine vasopressin, on the BRR sensitivity was examined. It was found that BRR sensitivity decreased significantly on day 7 of tail suspension. However, the BRR sensitivity was not significantly altered by the administration of the V2 antagonist either before tail suspension or after the release. I.S.

A91-20559\* Arizona Univ., Tucson.

**BETA-ADRENERGIC EFFECTS ON CARBOHYDRATE METABOLISM IN THE UNWEIGHTED RAT SOLEUS MUSCLE**

CHRISTOPHER R. KIRBY and MARC E. TISCHLER (Arizona, University, Tucson) Journal of Applied Physiology (ISSN 0161-7567), vol. 69, Dec. 1990, p. 2113-2119. refs (Contract NAG2-384; NIH-RR-05675)

Copyright

The effect of unweighting on the response of the soleus-muscle carbohydrate metabolism to a beta-adrenergic agonist (isoproterenol) was investigated in rats that were subjected to three days of tail-cast suspension. It was found that isoproterenol promoted glycogen degradation in soleus from suspended rats to a higher degree than in weighted soleus from control rats, and had no effect in unweighted digitorum longus. However, isoproterenol did not have a greater inhibitory effect on the net uptake of tritium-labeled 2-deoxy-glucose by the unweighted soleus and that isoproterenol inhibited hexose phosphorylation less in the unweighted than in the control muscle. I.S.

A91-20561\* Louisville Univ., KY.

**SKELETAL MUSCLE RESPONSE TO SPACEFLIGHT, WHOLE BODY SUSPENSION, AND RECOVERY IN RATS**

X. J. MUSACCHIA, J. M. STEFFEN, R. D. FELL, and M. J. DOMBROWSKI (Louisville, University, KY) Journal of Applied Physiology (ISSN 0161-7567), vol. 69, Dec. 1990, p. 2248-2253. Research supported by the Southern Regional Education Board. refs

(Contract NAG2-386; NASA ORDER A-21996-C)

Copyright

The effects of a 7-day spaceflight (SF), 7- and 14-day-long whole body suspension (WBS), and 7-day-long recovery on the muscle weight and the morphology of the soleus and the extensor digitorum longus (EDL) of rats were investigated. It was found that the effect of 7-day-long SF and WBS were highly comparable for both the soleus and the EDL, although the soleus muscle from SF rats showed greater cross-sectional area reduction than that from WBS rats. With a longer duration of WBS, there was a continued reduction in cross-sectional fast-twitch fiber area. Muscle plasticity, in terms of fiber and capillary responses, showed differences in responses of the two types of muscles, indicating that antigravity posture muscles are highly susceptible to unloading. I.S.

A91-21801\* Washington Univ., Seattle.

**A NONLINEAR MODEL OF THE PHASIC DYNAMICS OF MUSCLE ACTIVATION**

BLAKE HANNAFORD (Washington, University, Seattle) IEEE Transactions on Biomedical Engineering (ISSN 0018-9294), vol. 37, Nov. 1990, p. 1067-1075. Research supported by NASA. refs

Copyright

A phasic excitation-activation (PEXA) model is presented of the process of motoneuron excitation and the resultant activation and force development of a motor unit. The model input is an amount of depolarizing current (as when injected with an intracellular electrode), and the model output is muscle force. The model includes dynamics and nonlinearities similar to phenomena discovered experimentally by others: the firing rate response of motoneurons to steps of depolarizing current and the catch-like enhancement of force produced by overlapping motor neuron action potentials. The parameter values used in this model are derived from experimentally measured data and are expressed in physical units. Model predictions extend to published data beyond those used in generating the model parameter values. I.E.

A91-22050

**MECHANISMS OF SIMULTANEOUS INCREASE OF HEAT AND COLD RESISTANCE IN RATS [O MEKHANIZMAKH ODNOVREMENNOGO POVYSHENIIA USTOICHIVOSTI K RYS K TEPLU I KHOLODU]**

IU. I. ROSSOMAKHIN (Donetskii Gosudarstvennyi Universitet,

Donetsk, Ukrainian SSR) Fiziologicheskii Zhurnal SSSR (ISSN 0015-329X), vol. 76, Aug. 1990, p. 1078-1083. In Russian. refs Copyright

The effect of daily exposures of rats adapted to warm (daily periods of 4 h at 38 C) and cold (80-min periods at -4 C), environments to alternating periods of warm (38 C, 4 hr) and cold (-7 C to 2 C, 16 hr) environments on the resistance of these animals to cold and heat was investigated. It was found that, in rats preadapted to a warm environment, three months of warm-cold treatment resulted in increased resistance to both cold and heat; this was due to an increased heat exchange through evaporative salivation and heat generation. The thermogenesis of these rats was higher than that of rats adapted to a cold environment. This is considered to be due to a smaller influence of thyroid glands in heat-adapted rats, compared to cold-adapted rats, and to an increased role of the sympatho-adrenal system. I.S.

A91-22105

**ULTRASTRUCTURE OF LIVER CELLS DURING STRESS [UL'TRASTRUKTURA KLETOK PECHENI PRI STRESSE]**

VIACHESLAV A. SHKURUPII (Novosibirsk, Izdatel'stvo Nauka, 1989, 144 p. In Russian. refs

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This monograph discusses the nature of adaptive subcellular structural changes that occurred in liver cells of mice of three genetic types in response to mechanical stress (violent shaking) of different intensity, rhythm, and duration. Consideration is also given to changes caused in liver cellular organelles by injections of 'adaptive' hormones, such as glucagon, adrenaline, and hydrocortisone, and to the effect of acute stress on the structural changes of liver cells caused by injections of CCl<sub>4</sub>. Particular attention is given to the influence of the genetic background on the adaptive response of the animal's liver cells to a CCl<sub>4</sub> injection. I.S.

A91-23442

**EFFECT OF SPACE FLIGHTS ON PLASMA HORMONE LEVELS IN MAN AND IN EXPERIMENTAL ANIMAL**

L. MACHO, R. KVETNANSKY, M. VIGAS, S. NEMETH (Slovenska Akademia Vied, Ustav Experimentálnej Endokrinologie, Bratislava, Czechoslovakia), I. POPOVA (Institut Mediko-Biologicheskikh Problem, Moscow, USSR) et al. (IAA, IAF, AN SSSR, et al., Symposium on Man in Space, 8th, Tashkent, Uzbek SSR, Sept. 29-Oct. 3, 1990) Acta Astronautica (ISSN 0094-5765), vol. 23, 1991, p. 117-121. refs

Copyright

While increases of plasma hormone levels of insulin, TSH, and aldosterone are very generally stimulated in human subjects by spaceflight, the changes in plasma content of ACTH, cortisol, adrenaline, and noradrenaline exhibit considerable individual variations depending on space-flight numbers and durations. Experiments with small animals have been conducted concerning these changes in the Cosmos series space missions. The increase of corticosterone in plasma is followed by the activation of enzymes involved in the amino-acid metabolism in rat livers. After a 2-6-day recovery period, the plasma corticosterone concentration and the level of liver enzymes returned to control levels. O.C.

A91-23450

**PROBLEMS OF MICROBIAL ECOLOGY IN MANNED SPACE MISSION**

N. N. LIZKO (Institut Mediko-Biologicheskikh Problem, Moscow, USSR) (IAA, IAF, AN SSSR, et al., Symposium on Man in Space, 8th, Tashkent, Uzbek SSR, Sept. 29-Oct. 3, 1990) Acta Astronautica (ISSN 0094-5765), vol. 23, 1991, p. 163-169. refs

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The severity of problems caused by increased amounts of microbial activity during long-term manned space missions is discussed. Results from a study of the microbial activity occurring in 20 cosmonauts exposed to long-term space flight are discussed. Changes in levels of separate microorganisms after flights including endobacteria, clostridia, and lactobacilli are discussed. Changes

in the microecology of the intestine by stress-reaction are tracked, noting that significant changes occur in immunological resistance. L.K.S.

**A91-23466\*** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.

#### **MAN IN SPACE - THE USE OF ANIMAL MODELS**

RODNEY W. BALLARD and KENNETH A. SOUZA (NASA, Ames Research Center, Moffett Field, CA) (IAA, IAF, AN SSSR, et al., Symposium on Man in Space, 8th, Tashkent, Uzbek SSR, Sept. 29-Oct. 3, 1990) Acta Astronautica (ISSN 0094-5765), vol. 23, 1991, p. 295-297.

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The use of animal surrogates as experimental subjects in order to provide essential missing information on the effects of long-term spaceflights, to validate countermeasures, and to test medical treatment techniques is discussed. Research needs also include the definition of biomedical adaptations to flight, and the developments of standards for safe space missions to assure human health and productivity during and following flight. NASA research plans in this area are outlined. Over the next 40 years, NASA plans to concentrate on the use of rodents and nonhuman primates as the models of choice for various physiological responses observed in humans during extended stays in space. This research will include flights on the Space Shuttle, unmanned biosatellites, and the Space Station Freedom. L.K.S.

**A91-23467**

#### **CONCEPT OF 'MEDILAB' ORBITAL BIO-MEDICAL LABORATORY**

V. M. BARANOV, E. A. IL'IN, S. F. KHOLIN, IU. R. IVANOVSKII, N. V. PRAVETSKII (Institut Mediko-Biologicheskikh Problem, Moscow, USSR) et al. (IAA, IAF, AN SSSR, et al., Symposium on Man in Space, 8th, Tashkent, Uzbek SSR, Sept. 29-Oct. 3, 1990) Acta Astronautica (ISSN 0094-5765), vol. 23, 1991, p. 299-306.

Copyright

A general overview is provided of the Medilab project. Goals of this project include the study of physiological systems at different stages of space flight; the acquisition of data on body potentials and adaptation in extreme environmental conditions; and the development of a high-performance system of biomedical support. A list of potential Medilab investigations, requirements for their fulfillment, and expected benefits to be derived is presented. Diagrams are provided of the ground-based experimental center, a potential 'one-module' Medilab as well as a 'multi-module' Medilab, and of a proposed biomedical processing system. The benefits to be derived from international cooperation is stressed.

L.K.S.

**A91-23471**

#### **TELESCIENCE TESTBED IN HUMAN SPACE PHYSIOLOGY**

SATORU WATANABE, HISAO SEO, SATOSHI IWASE, MASAFUMI TANAKA, SAYUMI KANEKO (Nagoya University, Japan) et al. (IAA, IAF, AN SSSR, et al., Symposium on Man in Space, 8th, Tashkent, Uzbek SSR, Sept. 29-Oct. 3, 1990) Acta Astronautica (ISSN 0094-5765), vol. 23, 1991, p. 327-333. refs

Copyright

The feasibility of physiological experimentation under tele-science conditions is studied. A water immersion facility for simulated weightlessness was employed, with a control room to simulate the payload operational control center. The effects of reduced laboratory facilities, delay of communication between researchers and operators, and of several experiments being performed simultaneously by a single operator are evaluated. Three days of experiments with rotating operators (medical doctors without special expertise in physiological research) were conducted. ECG, blood pressure, echocardiograph, laser Doppler skin blood flowmetry, and blood sampling data were monitored. The quality of the data is assessed, as well as the effectiveness of the interaction between participants. A.F.S.

**A91-23511**

#### **CARDIAC OUTPUT BY IMPEDANCE CARDIOGRAPHY - TWO ALTERNATIVE METHODOLOGIES COMPARED WITH THERMODILUTION**

ANDREW SHERWOOD, LAWRENCE S. CARTER, JR., and CHARLES A. MURPHY (North Carolina, University, Chapel Hill) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 62, Feb. 1991, p. 116-122. Research supported by NIH. refs

Copyright

Two alternative methods for quantifying impedance cardiac output were assessed for the accuracy and reliability by comparing the cardiac output values derived for six anesthetized dogs with simultaneous thermodilution measures. In the experiment, the values of the component  $dZ/dt(\max)$  of the Kubicek (1966) equation were quantified relative to  $dZ/dt = 0$  baseline or relative to the  $dZ/dt$  B-point and were entered into the Kubicek equation to generate two cardiac output measures designated as impedance-A and impedance-B, respectively. Alterations in cardiac output were produced by intravenously administering isoproterenol, phenylephrine, or nitroprusside. The correlations of impedance cardiac output with thermodilution (periodic 10-ml-vol injections of ice-cold saline) were found to be higher for the impedance-A method than for the impedance-B method, supporting the use of the  $dZ/dt(\max)$  value relative to  $dZ/dt = 0$  (rather than relative to the  $dZ/dt$  B-point) in the Kubicek stroke volume equation. I.S.

**N91-15666#** Harvard Univ., Cambridge, MA. Dept. of Chemistry.

#### **SIMULATIONS OF BIOMOLECULAR DYNAMICS Final Report, 15 Jun. 1987 - 14 Feb. 1990**

1990 3 p

(Contract DE-FG02-87ER-60543)

(DE91-001977; DOE/ER-60543/3) Avail: NTIS HC/MF A01

The basic objective of the research supported by the Department of Energy grant has been to increase our understanding of and predictive ability for macromolecular systems (proteins, nucleic acids, etc.) of biological interest. For this purpose a wide range of large-scale simulations were made. They are concerned with equilibrium and non-equilibrium phenomena on time scales of up to a nanosecond for isolated macromolecules and macromolecules in solution. As a result of such simulations, a fundamental increase in our knowledge of the dynamical and thermodynamic properties and functions of such macromolecules, as well as more complex assemblies of biological interest has been achieved. Of particular interest are simulations of protein folding and the prediction of structural and thermodynamic changes in proteins and protein-liganded interactions induced by site-directed mutagenesis. Recent advances in computational techniques, including simulation methods for free energy changes, have been used for determining how to modify existing proteins to introduce altered properties. A molecular dynamics simulation method has been used for determining the contributions of individual amino acid residues and solvent molecules to free energy changes in proteins. A method was developed for protein secondary structure prediction based on a neural network and molecular dynamics simulations were used to calculate incoherent neutron scattering spectra of myoglobin. DOE

**N91-15667#** Argonne National Lab., IL. Chemistry Div.

#### **STRATEGIES FOR MIMICKING THE PRIMARY EVENTS OF BACTERIAL PHOTOSYNTHESIS: STRUCTURE, FUNCTION, AND MECHANISM**

JAMES R. NORRIS and MALA RAGHAVAN (Chicago Univ., IL.) 1990 12 p Presented at the 8th International Conference on Photochemical Conversion and Storage of Solar Energy, Palermo, Italy, 15-20 Jul. 1990

(Contract W-31-109-ENG-38)

(DE91-004449; CONF-900785-1) Avail: NTIS HC/MF A03

Some of the possible implications of the photochemistry of photosynthesis for artificial systems are presented. A major aspect of this paper involves the special conditions required to prevent the undesirable charge recombination via the excited triplet state

## 51 LIFE SCIENCES (GENERAL)

of the primary donor. If a multi-jump model is operative in the primary events of photosynthesis, then artificial model systems are relatively easy to synthesize. Such systems prevent back reactions via a series of downhill chemical reactions. Each downhill step in energy results in an increase in charge separation distance. The annihilation reactions, even to the less energetic triplet state, involve intermediate states uphill in energy and consequently are greatly diminished. However, if superexchange is a correct explanation of photosynthesis, then model systems have not been developed that properly mimic the natural process. In particular, the triplet back reaction can occur due to the lack of any thermal activation barrier. In nature this downhill back reaction appears to be prevented by carefully balancing the energetics using four molecules in the electron transport system. If this is the case, artificial photosynthesis would also require fine tuning of the coupling and energetics with three or four molecules making duplication more difficult to achieve. DOE

**N91-15668#** Pacific Northwest Lab., Richland, WA.

### **PHENOMENOLOGICAL MODELS**

L. A. BRABY Sep. 1990 52 p Presented at the Physical and Chemical Mechanisms in Molecular Radiation Biology Conference, Woods Hole, MA, 4-7 Sep. 1990  
(Contract DE-AC06-76RL-01830)  
(DE91-004737; PNL-SA-18754; CONF-9009267-3) Avail: NTIS HC/MF A04

The biological effects of ionizing radiation exposure are the result of a complex sequence of physical, chemical, biochemical, and physiological interactions. One way to begin a search for an understanding of health effects of radiation is through the development of phenomenological models of the response. Many models have been presented and tested in the slowly evolving process of characterizing cellular response. A range of models covering different endpoints and phenomena has developed in parallel. Many of these models employ similar assumptions about some underlying processes while differing about the nature of others. An attempt is made to organize many of the models into groups with similar features and to compare the consequences of those features with the actual experimental observations. It is assumed that by showing that some assumptions are inconsistent with experimental observations, the job of devising and testing mechanistic models can be simplified. DOE

**N91-15669** Tel-Aviv Univ. (Israel). School of Chemistry.

### **ISOLATION AND STRUCTURE ELUCIDATION OF BIOLOGICAL ACTIVE NATURAL PRODUCTS FROM MARINE SOURCES M.S. Thesis**

SARAH ISAACS Feb. 1989 81 p In HEBREW; ENGLISH summary  
(ITN-91-85081) Copyright Avail: Tel-Aviv Univ., Exact Sciences Library, Ramat Aviv 69978, Israel

The present research focused on the isolation of biologically active compounds from marine organisms collected from the Red Sea, and on the structural elucidation of these compounds by advanced spectroscopic techniques, in particular, 2D nuclear magnetic resonance (NMR) experiments. A wide range of biological tests were performed on the compounds isolated from these marine organisms at the Harbor Branch Oceanographic Institution, Florida, focusing on three particular areas: cytotoxic activity against P388 mouse leukemia cells, antiviral activity against four types of viruses (A-59, HSV-1, VSV and FELV) and anti-microbial activity. Within the context of this work, certain compounds were isolated and their structure elucidated as follows: (1) from the gorgoniae *Rumphella* sp. a carotenoid containing a C37 carbon skeleton was isolated; (2) from the sponge *Sarcotragus ramosa* a terpenoid with anti-cancer and anti-microbial properties was isolated; (3) from the sponge *Acanthella carteri* several fractions possessing anti-cancer and anti-viral properties were isolated; and (4) from the gorgoniae *Junceella juncea* six new diterpenoids belonging to the Briarein group were isolated. Author (ISA)

**N91-15670#** California Univ., Berkeley. Lawrence Berkeley Lab. Cell and Molecular Biology Div.

### **ELECTRON CRYSTALLOGRAPHY OF PHOE PORIN, AN OUTER MEMBRANE, CHANNEL-FORMING PROTEIN FROM E. COLI Ph.D. Thesis**

PETER J. WALIAN Nov. 1989 170 p Sponsored in part by National Inst. of Health  
(Contract DE-AC03-76SF-00098)  
(DE91-001790; LBL-28625) Avail: NTIS HC/MF A08

One approach to studying the structure of membrane proteins is the use of electron crystallography. Dr. Bing Jap has crystallized PhoE pore-forming protein (porin) from the outer membrane of *Escherichia coli* (*E. coli*) into monolayer crystals. The findings of this research and those of Jap (1988, 1989) have determined these crystals to be highly ordered, yielding structural information to a resolution of better than 2.8 angstroms. The task of this thesis has been to collect and process the electron diffraction patterns necessary to generate a complete three-dimensional set of high resolution structure factor amplitudes of PhoE porin. Fourier processing of these amplitudes when combined with the corresponding phase data is expected to yield the three-dimensional structure of PhoE porin at better than 3.5 angstroms resolution. DOE

**N91-15671#** California Univ., Berkeley. Lawrence Berkeley Lab. Information and Computing Sciences Div.

### **DATA INTERCHANGE STANDARDS FOR BIOTECHNOLOGY: ISSUES AND ALTERNATIVES**

JOHN L. MCCARTHY Jun. 1990 24 p  
(Contract DE-AC03-76SF-00098)  
(DE91-004114; LBL-29385) Avail: NTIS HC/MF A03

This report outlines a framework for discussion of what aspects of biotechnical information might be good candidates for guidelines or standards, what existing data exchange standards might be appropriate building blocks upon which to build, and what procedural mechanisms might be appropriate for adoption of such guidelines or standards. It builds on experience from other scientific communities which have already benefitted from development of discipline-specific data exchange standards. DOE

**N91-15672#** Pacific Northwest Lab., Richland, WA.

### **PROCEEDINGS OF THE RELEVANCE OF MASS SPECTROMETRY TO DNA SEQUENCE DETERMINATION: RESEARCH NEEDS FOR THE HUMAN GENOME PROGRAM WORKSHOP**

C. G. EDMONDS, R. D. SMITH, and L. M. SMITH (Wisconsin Univ., Madison.) Nov. 1990 50 p Workshop held in Seattle, WA, 4-5 Apr. 1990  
(Contract DE-AC06-76RL-01830)  
(DE91-004117; PNL-SA-18679; CONF-9004251-SUMM) Avail: NTIS HC/MF A03

A workshop was sponsored for the U.S. Department of Energy (DOE), Office of Health and Environmental Research by Pacific Northwest Laboratory, April 4 to 5, 1990, in Seattle, Washington, to examine the potential role of mass spectrometry in the joint DOE/National Institutes of Health (NIH) Human Genome Program. The workshop was occasioned by recent developments in mass spectrometry that are providing new levels for selectivity, sensitivity, and, in particular, new methods of ionization appropriate for large biopolymers such as DNA. During discussions, three general mass spectrometric approaches to the determination of DNA sequence were considered: (1) the mass spectrometric detection of isotopic labels from DNA sequencing mixtures separated using gel electrophoresis; (2) the direct mass spectrometric analysis from direct ionization of unfractionated sequencing mixtures where the measured mass of the constituents functions to identify and order the base sequence (replacing separation by gel electrophoresis); and (3) an approach in which a single highly charged molecular ion of a large DNA segment produced is rapidly sequenced in an ion cyclotron resonance ion trap. The consensus of the workshop was that, on the basis of the new developments, mass spectrometry has the potential to provide the substantial increases in sequencing speed required for the Human Genome Program. DOE

**N91-15673\*#** National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, AL.

**THE ROTATING SPECTROMETER: NEW BIOTECHNOLOGY FOR CELL SEPARATIONS**

DAVID A. NOEVER (Universities Space Research Association, Huntsville, AL.) and HELEN C. MATSOS Nov. 1990 14 p (NASA-TM-103522; NAS 1.15:103522) Avail: NTIS HC/MF A03 CSCL 06C

An instrument for biochemical studies, called the rotating spectrometer, separates previously inseparable cell cultures. The rotating spectrometer is intended for use in pharmacological studies which require fractional splitting of heterogeneous cell cultures based on cell morphology and swimming behavior. As a method to separate and concentrate cells in free solution, the rotating method requires active organism participation and can effectively split the large class of organisms known to form spontaneous patterns. Examples include the biochemical star, an organism called *Tetrahymena pyriformis*. Following focusing in a rotated frame, the separation is accomplished using different radial dependencies of concentrated algal and protozoan species. The focusing itself appears as concentric rings and arises from the coupling between swimming direction and Coriolis forces. A dense cut is taken at varying radii and extraction is replenished at an inlet. Unlike standard separation and concentrating techniques such as filtration or centrifugation, the instrument is able to separate motile from immotile fractions. For a single pass, typical split efficiencies can reach 200 to 300 percent compared to the inlet concentration.

Author

**N91-15674\*#** National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, AL.

**A BIOSENSOR FOR CADMIUM BASED ON BIOCONVECTIVE PATTERNS**

DAVID A. NOEVER (Universities Space Research Association, Huntsville, AL.) and HELEN C. MATSOS Nov. 1990 19 p (NASA-TM-103523; NAS 1.15:103523) Avail: NTIS HC/MF A03 CSCL 06C

An 'in vitro' method for monitoring cadmium, one of the most lethal bivalent heavy metals, can detect biologically active levels. The effects of cadmium tend to concentrate in protozoa far above natural levels and therein begin transferring through freshwater food chains to animals and humans. In a small sample volume (approximately 5 ml) the method uses the toxic response to the protozoa, *Tetrahymena pyriformis*, to cadmium. The assay relies on macroscopic bioconvective patterns to measure the toxic response, giving a sensitivity better than 1 micro-g/l and a toxicity threshold to 7 micro-g/l for Cd(2+). Cadmium hinders pattern formation in a dose-dependent manner. Arrested organism growth arises from slowed division and mutation to non-dividing classes. Unlike previous efforts, this method can be performed in a shallow flow device and does not require electronic or chemical analyses to monitor toxicity.

Author

**N91-16537#** Southwest Research Inst., San Antonio, TX. **INVESTIGATION OF EFFECTS OF 60-HZ ELECTRIC AND MAGNETIC FIELDS ON OPERANT AND SOCIAL BEHAVIOR AND ON THE NEUROENDOCRINE SYSTEM OF NONHUMAN PRIMATES Annual Report**

JOHN L. ORR Oct. 1989 88 p (Contract DE-AC02-80RA-50219) (DE90-010809; DOE/RA-50219/T10) Avail: NTIS HC/MF A05

The objective is to investigate, using the baboon as a nonhuman primate surrogate for the human, behavioral and neuroendocrine effects associated with exposure to 60-Hz electric and magnetic fields. Results from this program could be used to estimate and evaluate the likelihood of deleterious consequences resulting from exposure of humans to the electric and magnetic fields associated with electric power transmission. This project year has focused on two technical areas: the modification of the facility to include 60-Hz magnetic fields, and development of the capability for studies of neuroendocrine parameters by obtaining blood samples from baboons during electric and magnetic field exposure. Activities in

the social behavior, operant behavior, and laboratory animal sciences during this project year have been in preparation for the start of experiment 3.

DOE

**N91-16538#** Lawrence Livermore National Lab., CA.

**APPLICATION OF AMS TO THE BIOMEDICAL SCIENCES**

J. S. VOGEL, B. L. GLEDHILL, I. D. PROCTOR, K. W. TURTELTAUB, D. E. NELSON, J. C. DAVIS, J. S. FELTON, and J. R. SOUTHON 18 Apr. 1990 16 p Presented at the 5th International Conference on Accelerator Mass Spectrometry, Paris, France, 23-27 Apr. 1990

(Contract W-7405-ENG-48)

(DE90-010869; UCRL-102985; CONF-900491-5) Avail: NTIS HC/MF A03

Radioisotopic tracers are a useful tool in numerous areas of biomedical research, including metabolism, pharmacokinetics, and the detailed study of biomolecular interactions. Accelerator mass spectrometry (AMS) was suggested as a tool for the biomedical sciences shortly after its invention, but few attempts to use its sensitivity in such research have been reported. We have examined some of the strengths and limitations of the technique and find that AMS has a sensitivity advantage over decay-counting for the long-lived radioisotopes and for shorter-lived, common radiotracers. The advantage can be translated into the use of much smaller sample sizes and much lower radioisotope concentrations, both of which present new opportunities for biochemical tracing and human research. New approaches to separation and preparation of the material to be assayed for radiotracers will be developed to take advantage of the sensitivity and specificity. Most biochemical laboratories have used radioactive isotopes as tracers, and their facilities have been contaminated with unacceptably high levels of these tracers. Careful protocols and/or new facilities are required to prevent contamination of the AMS samples.

DOE

**N91-16539#** Southwest Research Inst., San Antonio, TX. **INVESTIGATION OF EFFECTS OF 60-HZ ELECTRIC AND MAGNETIC FIELDS ON OPERANT AND SOCIAL BEHAVIOR AND ON THE NEUROENDOCRINE SYSTEM OF NONHUMAN PRIMATES Quarterly Technical Progress Report No. 28, 1 Nov. 1988**

JOHN L. ORR 24 Mar. 1989 84 p

(Contract DE-AC02-80RA-50219; SWRI PROJ. 14-6253)

(DE90-011557; DOE/RA-50219/T13) Avail: NTIS HC/MF A05

The objective of this program is to investigate, using the baboon as a nonhuman primate surrogate for the human, behavioral and neuroendocrine effects associated with exposure to 60-Hz electric and magnetic fields. Results from this program, along with information from experiments conducted elsewhere, could be used to estimate and evaluate the likelihood of deleterious consequences resulting from exposure of humans to the electric and magnetic fields associated with electric power transmission. The test facility is being modified to include combined electric and magnetic field capability. This will be accomplished by the installation of a magnetic field exposure system and modification of the electric field exposure equipment. The purpose of this document is to provide information on the design.

DOE

**N91-16540#** Tennessee Univ., Memphis. Dept. of Anatomy and Neurobiology.

**CHANGES IN SOMATOSENSORY RESPONSIVENESS IN BEHAVING MONKEYS Annual Technical Report No. 2, 1 Jul. 1989 - 30 Jun. 1990**

RANDALL J. NELSON 31 Jul. 1990 24 p

(Contract AF-AFSR-0179-88; AF PROJ. 2312)

(AD-A226832; AFOSR-90-0956TR) Avail: NTIS HC/MF A03 CSCL 06/4

Four research goals were accomplished: (1) It was determined that sensory responsiveness of primary somatosensory (SI) cortical neurons to vibratory stimuli is quantitatively different depending upon whether monkeys make wrist movements in response to the stimuli or withhold movement. (2) For a special class of SI neurons, it was determined that activity occurring before movement is comprised of a reactivation of the neuron's sensor response and

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a presumably centrally generated component. (3) It was determined that sensory responsiveness and premovement activity are elevated when behavioral conditions are unpredictable as compared to when they are predictable. (4) It was determined that human subjects can acquire a positional target by wrist movements more quickly if vibratory go-cues are presented in addition to the illumination of a visual signal lamp. The neurophysiological experiments suggest that the responsiveness of SI neurons is profoundly affected by behavioral conditions and an animal's expectation of correct performance. The human psychophysical experiments suggest that the addition of vibratory go-cues to control systems may have benefits without seeming to degrade performance. GRA

**N91-16541#** Warwick Univ., Coventry (England). Dept. of Engineering.

### **ELECTRONIC ANALOGUE FOR A BIOLOGICAL NOSE**

H. V. SHURMER Sep. 1989 37 p Sponsored by United Kingdom Science and Engineering Research Council (ME-78; ETN-91-98576) Avail: NTIS HC/MF A03

The various facets of progress towards instrumentation capable of replacing or surpassing in performance the biological nose are described. Key areas providing continuing advances relate to sensor materials, integration of sensing elements, and information processing. The process of devising instrumentation has begun for some of the numerous applications awaiting exploitation. The topics discussed include: (1) an electronic model; (2) linearization and gas analysis; (3) test systems; (4) arrays of non-identical sensing elements; (5) information processing (pattern recognition); and (6) instrumentation. Also, different types of sensors are covered: inorganic semiconductors, conducting polymers, Langmuir-Blodgett films, and others. ESA

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### **AEROSPACE MEDICINE**

Includes physiological factors; biological effects of radiation; and effects of weightlessness on man and animals.

**A91-20531**

### **CIRCADIAN RHYTHMICITY AND SLEEP OF AIRCREW DURING POLAR SCHEDULES**

BARBARA M. STONE (RAF, Institute of Aviation Medicine, Farnborough, England), M. B. SPENCER, ALISON S. ROGERS, and A. N. NICHOLSON Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 62, Jan. 1991, p. 3-13. Research supported by the Civil Aviation Authority and British Airways, PLC. refs

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Sleep and circadian rhythms of aircrew were studied during a 7-d polar schedule operated between London and Tokyo. Sleep, rectal temperature, and subjective alertness were recorded for 2 d before departure during the schedule, and for 10 d after the return. Changes in sleep during the early part of the trip were due to sleep loss on the outward journey, but later these changes were related to the displacement of the circadian rhythm. The acrophases of the circadian rhythms of temperature were delayed by the outward journey, and amplitudes were reduced throughout the trip. During the return, aircrew reported high levels of tiredness which persisted until the second recovery night. Though the amounts of sleep obtained during the schedule were satisfactory for the aircrew as a group, some crewmembers experienced difficulties. Realignment of circadian rhythms was attained by an advance of the circadian phase in eight aircrew and by a delay in three, and resynchronization was achieved in all cases within 6 d. Author

**A91-20532**

### **THE INFLUENCE OF TRANSMERIDIAN FLIGHT ON HUMAN CIRCULATING LYMPHOCYTES**

HIROFUMI OHKOSHI, ICHIRO ASUKATA, NAOKO TAJIMA, KANHACHIRO YAMAMOTO, MITSUO SASAKI (Japan Air Lines Co., Ltd., Flight Crew Medical Service Dept., Tokyo, Japan) et al. Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 62, Jan. 1991, p. 14-18. refs

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The influence of transmeridian flight on the number of circulating lymphocytes, which have a circadian rhythm with low values in the daytime, was studied. The number of T lymphocytes was found to be higher than the baseline value, yet its rhythmicity was maintained after eastward flight with an 8-h time difference. The number of OKB2(+) as well as Leu11(+) cells were suppressed after the flight. The change in the number of T lymphocytes occurred due to the increased number of OKT4(+) lymphocytes. There was no correlation between the number of OKT4(+) lymphocytes and the plasma cortisol level. These data showed that the number of helper/inducer T lymphocytes, B cells, and natural killer cells were affected by the physical conditions experienced after the flight. The changes in T lymphocytes were independent of those of plasma cortisol levels. Author

**A91-20533**

### **REPEATABILITY AND PROTOCOL COMPARABILITY OF PRESYNCOPEAL SYMPTOM LIMITED LOWER BODY NEGATIVE PRESSURE EXPOSURES**

J. TIMOTHY LIGHTFOOT (Florida Atlantic University, Boca Raton), FREDERICK HILTON, JR., and SUZANNE M. FORTNEY (Johns Hopkins University, Baltimore, MD) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 62, Jan. 1991, p. 19-25. refs

(Contract NIH-HL-07534; NIH HL-10342)

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A study was conducted to determine the repeatability within the same subject of presyncopeal symptom-limited (PSL) LBNP tolerance and the repeatability of heart rate and blood pressure responses up to the point of syncope and to investigate the effect of different stage durations on tolerance, heart rate, and blood pressure measured during PSL-LBNP testing. Four PSL-LBNP tests were conducted on the same time of day, separated by at least 72 hr, and using the same protocol, and five PSL-LBNP tests were conducted using protocols that varied in stage duration but not in pressure profile. Results showed that PSL-LBNP testing is a repeatable quantifiable stressor and that the heart rate and blood pressure responses to PSL-LBNP are independent of stage duration. It was also found that, when comparing protocols with different stage duration, the maximum negative pressure tolerated may be the best index of PSL-LBNP tolerance. I.S.

**A91-20538**

### **EXPERIMENTAL VERIFICATION OF EFFECTIVENESS AND HARMLESSNESS OF THE QIGONG MANEUVER**

SHU-XIA ZHANG, HONG-ZHANG GUO, BAI-SHENG JING, XUAN WANG, and LI-MIN ZHANG (Air Force PR China, Institute of Aviation Medicine, Beijing, People's Republic of China) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 62, Jan. 1991, p. 46-52. refs

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Results are presented on a series of experiments that demonstrate the effectiveness and the harmlessness of the Qigong (Q-G) anti-G maneuver described by Guo (1988). Eighteen active fighter pilots trained for the Q-G maneuver who were asked to perform the maneuver during a centrifuge test had, on the average, a +Gz tolerance to rapid onset rate equal to  $6.64 \pm 0.64$  G, as compared to a 3.82 G tolerance in unprotected condition. When the Q-G maneuver was performed wearing an anti-G suit, the +Gz tolerance increased to  $7.80 \pm 0.87$  G. Data are presented demonstrating that the Q-G maneuver does not cause hypoxia or hyperventilation. I.S.

**A91-20539\*** Humboldt State Univ., Arcata, CA.

### **EFFECTS OF PRE-EXPOSURES TO A ROTATING OPTOKINETIC DRUM ON ADAPTATION TO MOTION SICKNESS**



SENQI HU (Humboldt State University, Arcata, CA), ROBERT M. STERN, and KENNETH L. KOCH (Pennsylvania State University, University Park and Hershey) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 62, Jan. 1991, p. 53-56. refs (Contract NAG9-118)  
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The effects of two different preexposure procedures on the adaptation to motion-sickness-causing rotation motion in a rotating optokinetic drum were investigated in three groups of human subjects. The first (control) group had a standard 16-min exposure in a drum rotating at 60 deg/sec, with no preexposure. The second (incremental exposure) group had two separated 4-min preexposure periods, at 15 deg/min and 30 deg/min, immediately prior to the standard 16-min exposure. The third (abrupt exposure) group had the same preexposure but with the second rotation at 60 deg/min, followed by the standard exposure. It was found that subjects in the incremental exposure group had significantly fewer motion sickness symptoms during the standard rotation period than did the subjects in the other two groups. I.S.

#### A91-20540

##### MOTION SICKNESS IN OPERATIONAL BOMBER CREWS

TIMOTHY S. STRONGIN (Albuquerque, Samaritan Counseling Center, NM) and SAMUEL G. CHARLTON (USAF, Operational Test and Evaluation Center, Kirtland AFB, NM) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 62, Jan. 1991, p. 57-59. refs

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Airsickness has long been identified as a flying training issue. The present study sought to assess its impact in an operational setting. During a monthly wing safety meeting, 88 B-1B and B-52H crewmembers completed the 'B-1B Airsickness Research File' questionnaire. The questionnaire responses were analyzed using ANOVA, Chi-square median tests, and multiple regression analyses. The percent of flights in which airsickness was experienced was found to be a function of crew position but not of aircraft type or the interaction of crew position and aircraft type. The degree of in-flight incapacitation experienced, however, was significantly predicted by the combination of crew position, aircraft type, and the amount of experience flying in bombers. Pilots reported the least amount of incapacitation, as did crewmembers who flew the B-1B and crewmembers with less bomber experience. Airsickness was reported to be a frequent occurrence among non-pilots in both aircraft. Experienced crewmembers were more likely to report an impact on their duties. Author

#### A91-20541

##### DECOMPRESSION SICKNESS PRESENTING AS A VIRAL SYNDROME

FREDERICK W. RUDGE (USAF, School of Aerospace Medicine, Brooks AFB, TX) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 62, Jan. 1991, p. 60, 61. refs

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Decompression sickness (DCS) is a well-known hazard of exposure to significant variations in ambient pressure. The diagnosis and management of DCS is frequently a source of confusion. Although the majority of cases are manifested by joint or limb pains (Type I DCS), patients may present with a wide array of symptoms, such as neurologic deficits, headache, fatigue, nausea, and respiratory difficulty. A thorough knowledge of the differential diagnosis and a strong index of suspicion are crucial to the proper management of DCS. Presented herein are two cases of altitude-related DCS which were confused initially with a viral syndrome. A discussion of the symptoms of DCS is included. Author

#### A91-20542

##### THE NEW FAA NATIONAL AUTOMATED ECG NETWORK - SOME AVIATION MEDICAL EXAMINER EXPERIENCES

KENNETH N. BEERS, SR. and STANLEY R. MOHLER (Wright State University, Dayton, OH) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 62, Jan. 1991, p. 62-66. refs

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The Federal Aviation Administration (FAA) has required, since August 1, 1987, that aviation medical examiners transmit by telephone all electrocardiograms (ECGs) necessary for airman 'Class I' medical certification. In calendar year 1989, the FAA received 69,000 electronically transmitted electrocardiograms. Marquette Electronics software is used to interpret the ECG signals that are received from multichannel equipment. The single-channel transmitted ECGs are hand screened at present. The FAA 'automated' screening program is unique among governmental airman medical certification programs throughout the world. This paper presents, for potential future users, the authors' experiences with the new airman automated electrocardiographic certification requirement, and covers positive and negative features involved in the implementation and operation of the program. Author

#### A91-20557

##### EFFECT OF METOCLOPRAMIDE ON ANGIOTENSINS, ALDOSTERONE, AND ATRIAL PEPTIDE DURING HYPOXIA

S. VONMOOS, J. NUSSBERGER, B. WAEGER, J. BIOLLAZ, H. R. BRUNNER (Centre Hospitalier Universitaire Vaudois, Lausanne, Switzerland) et al. Journal of Applied Physiology (ISSN 0161-7567), vol. 69, Dec. 1990, p. 2072-2077. refs

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The effect of a dopamine antagonist metoclopramide on the responses of the various components of the renin-angiotensin system to acute hypoxemia was investigated. In the experiment, human subjects were monitored for 60 min while breathing air, then during 60 min of exposures to a hypoxic gas mixture (12 percent O<sub>2</sub>-88 percent N<sub>2</sub>), followed by another 45 min of air breathing. Metoclopramide was injected (10 mg dose) 30 min after the start of the exposure to hypoxic mixture. In the control experiment, preceding the hypoxia experiment by two weeks, the same subjects were injected metoclopramide (90 min after the start of the experiment) but were exposed to air only. It was found that, during hypoxemia, the release of aldosterone induced by metoclopramide was significantly smaller than in the control experiment. This decrease was associated with a slight increase of the immunoreactive atrial natriuretic factor and with a decrease in plasma angiotensin II levels, without any change in immunoreactive blood angiotensin I. I.S.

A91-20560\* National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, FL.

##### EFFECT OF VOLUNTARY VS. ARTIFICIAL ACTIVATION ON THE RELATIONSHIP OF MUSCLE TORQUE TO SPEED

GARY A. DUDLEY, ROBERT T. HARRIS, MARC R. DUVOISIN, BRUCE M. HATHER, and PAUL BUCHANAN (NASA, Kennedy Space Center; Bionetics Corp., Cocoa Beach, FL; Ohio University, Athens) Journal of Applied Physiology (ISSN 0161-7567), vol. 69, Dec. 1990, p. 2215-2221. refs

(Contract NAS10-10285)

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The suggestion by Phillips and Petrofsky (1980) and Wickiewicz et al. (1984) that artificial activation of the knee extensor muscles should result in greater relative changes in torque than those evident with maximal voluntary activation is examined by investigating the speed-torque relationship of the right knee extensor muscle group in eight human subjects in whom activation was achieved by 'maximal' voluntary effort or by electrical stimulation. Torque was measured at a specific knee angle during isokinetic concentric or eccentric actions at velocities between 0.17 and 3.66 rad/s and during isometric actions. It is shown that, with artificial activation, the relative changes in both eccentric and concentric torque were greater as the speed increased; the speed-torque relationship was independent of the extent of activation and was similar to that of an isolated muscle. On the other hand, activation by the central nervous system during maximal effort depended on the speed and the type of muscle action performed. I.S.

#### A91-20562

##### MODEL SIMULATIONS OF GAS MIXING AND VENTILATION DISTRIBUTION IN THE HUMAN LUNG



SYLVIA VERBANCK and MANUEL PAIVA (Bruxelles, Université Libre, Brussels, Belgium) *Journal of Applied Physiology* (ISSN 0161-7567), vol. 69, Dec. 1990, p. 2269-2279. Research supported by the Ministère de la Politique Scientifique and Fondation pour la Recherche Scientifique Médicale. refs

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This paper describes a lung model, developed on the basis of human acinar morphometry data obtained by Häfeli-Bleuer and Weibel (1988), that incorporates intraacinar diffusion- and convection-dependent inhomogeneities, interregional convection-dependent inhomogeneities (CDI), and intracinar CDI simultaneously. The model is used to simulate a particular multiple-breath N<sub>2</sub> washout maneuver with different values of the model parameters, and to investigate the effect of these parameters on the breath number dependence of S<sub>n</sub> (where S<sub>n</sub> is the normalized slope of the alveolar plateau of the N<sub>2</sub> curve) and on the Fowler and the Bohr dead spaces. The model is then used to simulate different washout experiments performed by Crawford et al. (1985, 1986, 1989) to investigate effects of the gas diffusivity and the preinspiratory lung volume on the multiple-breath washout.

I.S.

**A91-21710** Texas Univ., Dallas.

**PHYSICAL FITNESS AND CARDIOVASCULAR REGULATION - MECHANISMS OF ORTHOSTATIC INTOLERANCE**

BENJAMIN D. LEVINE, JAY C. BUCKEY, JANICE M. FRITSCH, CLYDE W. YANCY, JR., DONALD E. WATENPAUGH (Texas, University, Dallas; USVA, Medical Center; Virginia, Medical College, Richmond) et al. *Journal of Applied Physiology* (ISSN 0161-7567), vol. 70, Jan. 1991, p. 112-122. Research supported by USVA. refs

(Contract NAS9-16044; NAG9-297; NAG2-408; NIH-HL-22296)

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The mechanism of orthostatic intolerance observed in endurance-trained athletes was investigated by measuring progressive changes in the maximal oxygen uptake (during exercises on a bicycle ergometer), the maximal leg vasodilator capacity, the carotid baroreflex function, and the tolerance to LBNP in subjects of high, medium, and low fit conditions. Results provide suggestive evidence that highly fit endurance-trained athletes may have diminished tolerance to orthostatic stress compared with moderately fit or sedentary controls. However, the aerobic capacity data suggest that this phenomenon is not a simple linear function of fitness per se, but depends on a complex interaction among multiple parameters of cardiovascular regulation, only some of which may be affected by fitness. Of these, the maximal calf vascular conductance is an important factor. Athletes had larger maximal vascular conductance than nonathletes, while baroreflex function appeared to be unrelated to fitness or exercise training.

I.S.

**A91-21799**

**RELATIONSHIP OF NUTRITION TO DISEASE AND PERFORMANCE. I - BASIC NUTRITION**

R. GEORGE TROXLER (Southwest Research Institute, San Antonio, TX) *Aeromedical and Training Digest*, vol. 5, Jan. 1991, 3 p.

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A unique aspect of aerospace medicine is its interdisciplinary nature, i.e., the aviation physiologist must obtain information from a number of professional and academic areas and then apply it. Coronary artery disease, adult onset diabetes, hypertension, and obesity (as a contributing factor) are diseases that have been successfully treated by diet especially in their early stages. Epidemiologic evidence has shown an association between diet and morbidity and mortality from coronary heart disease, and there has been strong observational evidence that diet can affect both coronary lesion progression and formation of new lesions. This is important for flight crews to keep in mind as the alternative to dietary therapy for these diseases is often long term medication with possible side effects and therefore a shortened flying career.

R.E.P.

**A91-22250**

**PULSATILE FLOW OF BLOOD WITH PERIODIC BODY ACCELERATION**

P. CHATURANI and V. PALANISAMY (Indian Institute of Technology, Bombay, India) *International Journal of Engineering Science* (ISSN 0020-7225), vol. 29, no. 1, 1991, p. 113-121. Research supported by the Council of Scientific and Industrial Research. refs

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Pulsatile flow of blood through a rigid tube has been studied under the influence of body acceleration. With the help of finite Hankel and Laplace transforms, analytic expressions for axial velocity, fluid acceleration, wall shear and instantaneous volume flow rate have been obtained. The amplitude of the instantaneous volume flow rate, for flows with body acceleration, is shown to decrease sharply as the tube radius decreases (from aorta to arteriole). This variation of amplitude is very slow for flows with no body acceleration. Another interesting result is that the maximum of the axial velocity and fluid acceleration shifts from the tube axis to the vicinity of the tube wall as the tube diameter increases. The variation of the amplitude of wall shear with tube diameter (aorta to coronary) is less for flows with body acceleration than for flows with no body acceleration. The phase lag between pressure gradient and flow rate changes sharply with tube diameter in narrow tubes, and it varies asymptotically in wide tubes.

Author

**A91-23426\*** Ministry of Health of the USSR, Moscow.

**HUMANS IN EARTH ORBIT AND PLANETARY EXPLORATION MISSIONS; IAA MAN IN SPACE SYMPOSIUM, 8TH, TASHKENT, UZBEK SSR, SEPT. 29-OCT. 3, 1990, SELECTION OF PAPERS**

A. I. GRIGOR'EV, ED. (Institut Mediko-Biologicheskikh Problem, Moscow, USSR), K. E. KLEIN, ED. (DLR, Cologne, Federal Republic of Germany), and A. NICOGLOSSIAN, ED. (NASA, Life Sciences Div., Washington, DC) Symposium organized by IAA and IAF; Supported by AN SSSR, Ministerstvo Zdravookhraneniia SSSR, Sovet Interkosmos, et al. *Acta Astronautica* (ISSN 0094-5765), vol. 23, 1991, 362 p. For individual items see A91-23427 to A91-23472.

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The present conference on findings from space life science investigations relevant to long-term earth orbit and planetary exploration missions, as well as considerations for future research projects on these issues, discusses the cardiovascular system and countermeasures against its deterioration in the microgravity environment, cerebral and sensorimotor functions, findings to date in endocrinology and immunology, the musculoskeletal system, and health maintenance and medical care. Also discussed are radiation hazards and protective systems, life-support and habitability factors, and such methodologies and equipment for long space mission research as the use of animal models, novel noninvasive techniques for space crew health monitoring, and an integrated international aerospace medical information system.

O.C.

**A91-23427**

**PRELIMINARY MEDICAL RESULTS OF THE MIR YEAR-LONG MISSION**

A. I. GRIGOR'EV, S. A. BUGROV, V. V. BOGOMOLOV, A. D. EGOROV, I. B. KOZLOVSKAIA (Institut Mediko-Biologicheskikh Problem, Moscow, USSR) et al. (IAA, IAF, AN SSSR, et al., Symposium on Man in Space, 8th, Tashkent, Uzbek SSR, Sept. 29-Oct. 3, 1990) *Acta Astronautica* (ISSN 0094-5765), vol. 23, 1991, p. 1-8.

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Mir's December 21, 1987-December 21, 1988 (366-day) mission encompassed medical investigations of physiological responses to long microgravity exposure; in addition to conducting detailed examination of cardiovascular and other systems in flight, the efficacy of countermeasures against physiological deterioration was assessed. Cosmonaut physiology was carefully monitored after return to earth as well. The readaptation process was notably

similar to that experienced after flights of 6-11 months. No qualitatively distinctive changes were observed in vital body systems at the end of the mission, pointing to further prolongations of space missions. O.C.

**A91-23428\*** National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, FL.

**CAROTID-CARDIAC BAROREFLEX - RELAXATION WITH ORTHOSTATIC HYPOTENSION FOLLOWING SIMULATED MICROGRAVITY AND IMPLICATIONS FOR DEVELOPMENT OF COUNTERMEASURES**

VICTOR A. CONVERTINO (NASA, Kennedy Space Center, Cocoa Beach, FL) (IAA, IAF, AN SSSR, et al., Symposium on Man in Space, 8th, Tashkent, Uzbek SSR, Sept. 29-Oct. 3, 1990) Acta Astronautica (ISSN 0094-5765), vol. 23, 1991, p. 9-17. refs  
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An examination has been made of the function of the human carotid-cardiac baroreflex (CCB) under the influence of simulated microgravity, varying states of vascular volume, and acute exercise. Results have been obtained which suggest that acute fluid replacement prior to reentry may not reverse the impaired baroreflex associated with postflight hypotension. It is also noted that one bout of maximal exercise increased baroreflex sensitivity and buffer capacity through 24 hrs post exercise; these baroreflex changes were the opposite of those following head-down bedrest. Contributions of reduced blood volume and impaired CCB function to orthostatic hypotension following microgravity appear to be separate and additive, so that maximal exercise and fluid replacement could be a potent countermeasure against postflight hypotension. O.C.

**A91-23429  
EFFECTS OF 10 DAYS 6-DEG HEAD-DOWN TILT ON THE RESPONSES TO FLUID LOADING AND LOWER BODY NEGATIVE PRESSURE**

F. BAISCH, M. HEER, L. BECK (DLR, Institut fuer Flugmedizin, Cologne, Federal Republic of Germany), C. G. BLOMQVIST (Texas, University, Dallas), J. KROPP (Bonn, Universitaet, Federal Republic of Germany) et al. (IAA, IAF, AN SSSR, et al., Symposium on Man in Space, 8th, Tashkent, Uzbek SSR, Sept. 29-Oct. 3, 1990) Acta Astronautica (ISSN 0094-5765), vol. 23, 1991, p. 19-24. refs

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Six male subjects have been studied before, during, and after 10 days' 6-deg head-down tilt (HDT), determining urine volume and body weight daily; fluid-loading and lower body negative pressure (LBNP) were performed in all three study phases. The compliance of the lower limbs, expressed as the rate of limb volume change/unit LBNP change, increased at the end of the HDT phase and during the post-HDT phase. The set point of intravascular volume was defended, as shown by the response to fluid loss. HDT is found to have increased lower-limb compliance. O.C.

**A91-23430  
EFFECTS OF SALINE LOADING DURING HEAD DOWN TILT ON ANP AND CYCLIC GMP LEVELS AND ON URINARY FLUID EXCRETION**

C. DRUMMER (Muenchen, Universitaet, Munich, Federal Republic of Germany), R. E. LANG (Heidelberg, Universitaet, Federal Republic of Germany), F. BAISCH, M. HEER (DLR, Institut fuer Flugmedizin, Cologne, Federal Republic of Germany), G. BLOMQVIST (Texas, University, Dallas) et al. (IAA, IAF, AN SSSR, et al., Symposium on Man in Space, 8th, Tashkent, Uzbek SSR, Sept. 29-Oct. 3, 1990) Acta Astronautica (ISSN 0094-5765), vol. 23, 1991, p. 25-29. refs

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An investigation is conducted of the renal and humoral effects of acute saline infusions on six male volunteers before, during, and after a 10-day period of 6-deg head-down tilt (HDT). No difference was observed in the plasma atrial natriuretic peptide (ANP) and cyclic GMP changes among the pre-HDT, HDT, and post-HDT infusion experiments. Urine flow, sodium excretion, and

urinary cyclic GMP excretion were significantly increased. These data suggest that HDT does not induce major alterations in the regulation of an acute saline infusion and plasma ANP does not play a major role in the diuretic/natriuretic effects of volume loading. O.C.

**A91-23431  
NEURAL AND HUMORAL CONTROLLING MECHANISMS OF CARDIOVASCULAR FUNCTIONS IN MAN UNDER WEIGHTLESSNESS SIMULATED BY WATER IMMERSION**

T. MANO, S. IWASE, M. SAITO, K. KOGA, H. ABE (Nagoya University, Japan) et al. (IAA, IAF, AN SSSR, et al., Symposium on Man in Space, 8th, Tashkent, Uzbek SSR, Sept. 29-Oct. 3, 1990) Acta Astronautica (ISSN 0094-5765), vol. 23, 1991, p. 31-33. refs

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The control of cardiovascular functions under weightlessness by neural and humoral mechanisms is presently studied via microneurographic observations of sympathetic nerve activity during thermoneutral head-out water immersion. Immersion led to reductions of the plasma level of norepinephrine and the vasopressive and antidiuretic hormones, while markedly increasing vasodepressive and diuretic hormones. The suppressive effect on sympathetic nervous activity appears to be age-dependent, being less pronounced in elderly than in youthful subjects. The suppressive effect plays an important role in the maintenance of hemodynamic homeostasis under weightlessness, to compensate for the cephalad fluid shift. O.C.

**A91-23432  
HEMODYNAMIC EFFECTS OF MICROGRAVITY AND THEIR GROUND-BASED SIMULATIONS**

V. I. LOBACHIK, S. V. ABROSIMOV, V. V. ZHIDKOV, and D. K. ENDEKA (Institut Mediko-Biologicheskikh Problem, Moscow, USSR) (IAA, IAF, AN SSSR, et al., Symposium on Man in Space, 8th, Tashkent, Uzbek SSR, Sept. 29-Oct. 3, 1990) Acta Astronautica (ISSN 0094-5765), vol. 23, 1991, p. 35-40. refs

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Forty males of age 35-42 participated in the present radioactive isotope-based study of the hemodynamic effects of simulated microgravity, in which blood shifts were evaluated both qualitatively and quantitatively. The simulations encompassed bedrest, head-down tilt at -5 and -15 deg, and vertical water immersion. None of these methods adequately simulated the hemodynamic effects of microgravity. Renal fluid excretion in real and simulated microgravity was different with respect to both volumes and durations. The experiments have yielded data on the general pattern of circulation, with blood displaced to the upper body. O.C.

**A91-23433** National Aeronautics and Space Administration, Washington, DC.

**MATHEMATICAL MODELING OF ACUTE AND CHRONIC CARDIOVASCULAR CHANGES DURING EXTENDED DURATION ORBITER (EDO) FLIGHTS**

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The purpose of NASA's Extended Duration Orbiter program is a gradual extension of the capabilities of the Space Shuttle Orbiter beyond its current 7-10 day limit on mission duration, as warranted by deepening understanding of the long-term physiological effects of weightlessness. Attention is being given to the cardiovascular problem of orthostatic tolerance loss due to its adverse effects on crew performance and health during reentry and initial readaptation to earth gravity. An account is given of the results of

the application of proven mathematical models of circulatory and cardiovascular systems under microgravity conditions. O.C.

**A91-23434\*** National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.

**OCULOMOTOR FUNCTION DURING SPACE FLIGHT AND SUSCEPTIBILITY TO SPACE MOTION SICKNESS**

WILLIAM E. THORNTON (NASA, Johnson Space Center, Houston, TX) and JOHN J. URI (General Electric Co., Government Services Div., Houston, TX) (IAA, IAF, AN SSSR, et al., Symposium on Man in Space, 8th, Tashkent, Uzbek SSR, Sept. 29-Oct. 3, 1990) Acta Astronautica (ISSN 0094-5765), vol. 23, 1991, p. 53-61. refs

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Horizontal vestibulo-ocular reflex (VOR) and saccadic eye movements (SEM) were studied in 18 subjects before and during five Space Shuttle missions to evaluate the effects of weightlessness and correlations between results and susceptibility to and actual presence of space motion sickness (SMS). Active sinusoidal head oscillation was the stimulus for VOR tests with vision (VVOR), with eyes shaded (VOR-ES), and VOR suppression (VOR-S). Eye movements were recorded by electrooculography and head position by a potentiometer. No pathological nystagmus or other abnormal eye movements were seen. No significant in-flight changes were seen in the gain, phase shift or waveform of VVOR, VOR-ES or VOR-S. Statistically significant increases in saccadic latency and decreases in saccadic velocity were seen, with no change in saccadic accuracy. Preflight differences between SMS susceptible and nonsusceptible subjects were noted only in VOR-S, with less complete suppression in susceptible subjects, a finding also seen in flight. During flight, VVOR gain was significantly increased in three nonaffected subjects. Saccades of SMS-affected subjects showed increased latency and velocity and decreased accuracy compared to saccades of unaffected subjects. Author

**A91-23435**

**TRANSITION FROM SELF TILT TO OBJECT TILT DURING MAINTAINED LATERAL TILT IN PARABOLIC FLIGHT**

JOACHIM WETZIG, MICHAELA REISER, and RUDOLF J. VON BAUMGARTEN (Mainz, Universitaet, Federal Republic of Germany) (IAA, IAF, AN SSSR, et al., Symposium on Man in Space, 8th, Tashkent, Uzbek SSR, Sept. 29-Oct. 3, 1990) Acta Astronautica (ISSN 0094-5765), vol. 23, 1991, p. 63-67. refs

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Nineteen young healthy subjects were subjected to parabolic rollercoaster flight. A horizontal luminous line was seen by the subjects in a headfixed goggle device. During the hypergravic phases of parabolic flight the luminous line seemed to rotate into and during the hypogravic phase against the direction of static head tilt. Ocular counterrotation and activity of the neck-position receptors cannot explain these subjective rotations. It is concluded that information from the otolith system, converging with visual information within the brain, dislocated the headfixed visual target line. While the retinal image of the luminous line remains unchanged, loading and unloading the otoliths in parabolic flight changes the sensation of self tilt into object tilt, hereby subjectively rotating visual targets such as the luminous line. Author

**A91-23436**

**THE CALORIC VESTIBULAR NYSTAGMUS DURING SHORT LASTING MICROGRAVITY**

W. J. OOSTERVELD, H. A. A. DE JONG, and H. W. KORTSCHOT (Amsterdam, Universiteit, Netherlands) (IAA, IAF, AN SSSR, et al., Symposium on Man in Space, 8th, Tashkent, Uzbek SSR, Sept. 29-Oct. 3, 1990) Acta Astronautica (ISSN 0094-5765), vol. 23, 1991, p. 69-77. Research supported by SRON. refs

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Caloric vestibular testing was conducted during parabolic flight, with 10-min nystagmographic periods. The slow-phase velocity (SPV) of the caloric nystagmus was found to increase with rising g-value, while microgravity conditions induced an exponential decay. The nystagmus entirely disappeared in microgravity, but SPV decay showed a specific time constant. Because of the

similarities between the characteristics observed in both SPV decays and their associated time constants, it is suggested that a common working mechanism of cupular stimulation may be at work. The present results support the Barany (1907) convection theory with respect to the endolymph stimulatory properties following the caloric test. O.C.

**A91-23437**

**MODIFICATIONS OF SPONTANEOUS OCULOMOTOR ACTIVITY IN MICROGRAVITATIONAL CONDITIONS**

L. N. KORNILOVA, A. M. GONCHARENKO, V. V. POLIAKOV (Institut Mediko-Biologicheskikh Problem, Moscow, USSR), V. GRIGOROVA (B'lgarska Akademiia na Naukite, Institut po Fiziologija, Sofia, Bulgaria), and A. MANEV (B'lgarska Akademiia na Naukite, Institut za Kosmicheski Izsledvaniia, Sofia, Bulgaria) (IAA, IAF, AN SSSR, et al., Symposium on Man in Space, 8th, Tashkent, Uzbek SSR, Sept. 29-Oct. 3, 1990) Acta Astronautica (ISSN 0094-5765), vol. 23, 1991, p. 79-84. refs

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Measurements were conducted on cosmonaut spontaneous oculomotor activity prior to flight (five subjects), during flight (two subjects), and after flight (five subjects); the in-flight tests were made on the 3rd, 5th, and 164th days of the mission. The electrooculographic measurements were conducted by means of a PC-based automated data-acquisition system. In general, oculatory movement amplitudes increased in translations of the eyes to extreme positions; this was especially noticeable in the vertical direction, and occurred in conjunction with the correction of saccadic movements and an increase in the time of oculomotor fixing reactions. O.C.

**A91-23439**

**THE INVOLVEMENT OF CEREBROVASCULAR REACTIVITY IN PATHOGENESIS OF SPACE MOTION SICKNESS**

IU. E. MOSKALENKO, A. I. BEKETOV, G. B. VAINSHTAIN, V. F. MAKSIMUK, N. A. SKOROMNYI (AN SSSR, Institut Evoliutsionnoi Fiziologii i Biokhimii, Leningrad, USSR) et al. (IAA, IAF, AN SSSR, et al., Symposium on Man in Space, 8th, Tashkent, Uzbek SSR, Sept. 29-Oct. 3, 1990) Acta Astronautica (ISSN 0094-5765), vol. 23, 1991, p. 97-103. refs

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An investigation has been conducted of the involvement of cerebral circulation in space motion sickness pathogenesis. Two-hour rocking and antiorthostasis served as a model of zero-g conditions' influences on intracranial hemodynamics and liquorodynamics in rabbits. Cerebrovascular reactivity was evaluated as a function of the response of cerebral blood flow and intracerebral rheoencephalography to such functional loads as photostimulation, CO<sub>2</sub>-inhalation, and the Stokey test. Rocking and antiorthostasis resulted in a decrease of cerebrovascular reactivity and hyperhydration. The results show a significant decrease in the compensatory abilities of the cerebrovascular system under zero-g conditions. O.C.

**A91-23440\*** National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.

**METABOLISM AND BIOCHEMISTRY IN HYPOGRAVITY**

CAROLYN S. LEACH (NASA, Johnson Space Center, Houston, TX) (IAA, IAF, AN SSSR, et al., Symposium on Man in Space, 8th, Tashkent, Uzbek SSR, Sept. 29-Oct. 3, 1990) Acta Astronautica (ISSN 0094-5765), vol. 23, 1991, p. 105-108. refs

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The headward shift of body fluid and increase in stress-related hormones that occur in hypogravity bring about a number of changes in metabolism and biochemistry of the human body. Such alterations may have important effects on health during flight and during a recovery period after return to earth. Body fluid and electrolytes are lost, and blood levels of several hormones that control metabolism are altered during space flight. Increased serum calcium may lead to an increased risk of renal stone formation during flight, and altered drug metabolism could influence the efficacy of therapeutic agents. Orthostatic intolerance and an increased risk of fracturing weakened bones are concerns at

landing. It is important to understand biochemistry and metabolism in hypogravity so that clinically important developments can be anticipated and prevented or ameliorated. Author

#### A91-23441

##### ACTIVITY OF THE SYMPATHOADRENAL SYSTEM IN COSMONAUTS DURING 25-DAY SPACE FLIGHT ON STATION MIR

R. KVETNANSKY, P. BLAZICEK (Slovenska Akademia Vied, Ustav Experimentalnej Endokrinologie, Bratislava, Czechoslovakia), V. B. NOSKOV, I. A. POPOVA (Institut Mediko-Biologicheskikh Problem, Moscow, USSR), C. GHARIB (Lyon I, Universite, Villeurbanne, France) et al. (IAA, IAF, AN SSSR, et al., Symposium on Man in Space, 8th, Tashkent, Uzbek SSR, Sept. 29-Oct. 3, 1990) Acta Astronautica (ISSN 0094-5765), vol. 23, 1991, p. 109-116. refs Copyright

Cosmonaut sympathoadrenal system activity was studied by way of measurements of plasma, urinary catecholamines, and their metabolites and conjugates. The results obtained suggest that, in the comparatively short period of about nine days of space habitation, the sympathoadrenal system was somewhat activated, thereby indicating a mildly stressful influence's exertion by the initial phase of spaceflight. Such a short mission did not, by comparison with a long-term one, powerfully activate the sympathoadrenal system during the process of readaptation to earth gravity. While weightlessness is not a stressful factor in this system's activation, it sensitizes responsiveness during readaptation to earth gravity. O.C.

#### A91-23443

##### IMMUNE RESISTANCE OF MAN IN SPACE FLIGHTS

IRINA V. KONSTANTINOVA (Institut Mediko-Biologicheskikh Problem, Moscow, USSR) (IAA, IAF, AN SSSR, et al., Symposium on Man in Space, 8th, Tashkent, Uzbek SSR, Sept. 29-Oct. 3, 1990) Acta Astronautica (ISSN 0094-5765), vol. 23, 1991, p. 123-127. refs Copyright

The ability of PHA lymphocyte reactivity, T-helper activity, and NK capacity to recognize and destroy their targets has been noted in tests on 72 Salyut 6, 7, and Mir cosmonauts to decrease during the first week after prolonged (3-11-month) space flights. Alterations are also noted in the ultrastructure of the NK secretory and locomotor apparatus. The production of alpha-interferon remained unchanged, while that of gamma-interferon either rose or decreased. Several cosmonauts are noted to have shown a trend toward increased osteoclast-activating factor production. These reductions in immune system function may exacerbate the risks of disease during prolonged space flights. O.C.

#### A91-23444

##### THE STATE OF HUMAN BONE TISSUE DURING SPACE FLIGHT

V. S. OGANOV, A. S. RAKHMANOV, V. E. NOVIKOV (Institut Mediko-Biologicheskikh Problem, Moscow, USSR), S. T. ZATSEPIN, S. S. RODIONOVA (Tsentrul'nyi Nauchno-Issledovatel'skii Institut Travmatologii i Ortopedii, Moscow, USSR) et al. (IAA, IAF, AN SSSR, et al., Symposium on Man in Space, 8th, Tashkent, Uzbek SSR, Sept. 29-Oct. 3, 1990) Acta Astronautica (ISSN 0094-5765), vol. 23, 1991, p. 129-133. refs Copyright

Bone tissue studies have been conducted on cosmonauts after 4-8-month space flights, and their results have been compared with data from healthy individuals during head-down tilt studies lasting 370 days. The noninvasive methods of computer tomography and gamma-photon absorptiometry have revealed either a decrease in the vertebral spongy mineral's density or an increase by a comparable magnitude relative to an individual cosmonaut's preflight values. It is noted that, during clinical studies of osteoporosis, both vertebral mineral density ratios and the presence or absence of vertebral compression fractures are not equal in different age groups. O.C.

#### A91-23445

##### COMPARISON OF V'O<sub>2</sub> KINETICS IN UPRIGHT AND SUPINE POSITION

U. HOFFMANN, D. ESSFELD, J. STEGEMANN, and H. SCHUETZE (Koeln, Deutsche Sporthochschule, Cologne, Federal Republic of Germany) (IAA, IAF, AN SSSR, et al., Symposium on Man in Space, 8th, Tashkent, Uzbek SSR, Sept. 29-Oct. 3, 1990) Acta Astronautica (ISSN 0094-5765), vol. 23, 1991, p. 135-137. refs (Contract BMFT-01-QV-87354) Copyright

Oxygen uptake (V'O<sub>2</sub>) kinetics during exercise depends in particular on muscular aerobic capacity and cardiovascular parameters. The objective of this study was to investigate the influence of body position on the V'O<sub>2</sub> kinetics as determined by means of the PRBS technique. Nine healthy male volunteers performed bicycle ergometer exercises in both upright and supine positions. No significant changes were seen in normalized gains and phase shifts of the power-V'O<sub>2</sub>-relationship. It is concluded that the differences in venous blood volume distribution and cardiac output associated with upright and supine position do not have major effects on power-V'O<sub>2</sub>-gains. Author

#### A91-23446

##### CHANGES IN THE EXTRACELLULAR MUSCLE VOLUME AFFECT HEART RATE AND BLOOD PRESSURE RESPONSES TO STATIC EXERCISE

K. BAUM, D. ESSFELD, and J. STEGEMANN (Koeln, Deutsche Sporthochschule, Cologne, Federal Republic of Germany) (IAA, IAF, AN SSSR, et al., Symposium on Man in Space, 8th, Tashkent, Uzbek SSR, Sept. 29-Oct. 3, 1990) Acta Astronautica (ISSN 0094-5765), vol. 23, 1991, p. 139-147. refs (Contract BMFT-01-QV-8735) Copyright

Six male subjects performed three calf ergometer tests with different extracellular volumes of working muscles in order to investigate the effect of microgravity-induced peripheral extracellular fluid reductions on heart rate and blood pressure. Subjects had to counteract an external force of 180 N for 5 min. During the preexercise period, three different protocols were applied: (1) rest in the exercise position; (2) same position but with a calf volume increase via venous congestion; and (3) calf volumes decreased by negative hydrostatic pressure. Oxygen uptake did not exceed resting levels in (2) and (3) until cuffs were deflated, indicating an exclusive contribution of the calf muscles to the neurogenic peripheral drive. O.C.

#### A91-23447

##### THE PHYSICIAN-COSMONAUT TASKS IN STABILIZING THE CREW MEMBERS HEALTH AND INCREASING AN EFFECTIVENESS OF THEIR PREPARATION FOR RETURNING TO EARTH

V. V. POLIAKOV (Institut Mediko-Biologicheskikh Problem, Moscow, USSR) (IAA, IAF, AN SSSR, et al., Symposium on Man in Space, 8th, Tashkent, Uzbek SSR, Sept. 29-Oct. 3, 1990) Acta Astronautica (ISSN 0094-5765), vol. 23, 1991, p. 149-151. Copyright

A crewmember-physician used clinicophysiological and biochemical methods to evaluate the health of two Mir cosmonauts during the concluding 4 months of a 1-year mission, in order to assess their readiness for spacecraft reentry and postlanding activities. Tests were conducted of alternative exercise regimes and novel countermeasures to the deleterious long-term effects of weightlessness. Medical monitoring was also essential during the preparation for, and performance of, EVAs, which constitute the most complex and potentially dangerous portion of the flight program. Everyday activities for the crewmember-physician included the functions of a nutritionist. O.C.

#### A91-23448

##### MEDICAL REHABILITATION FOLLOWING LONG-TERM SPACE MISSIONS

T. D. VASIL'eva and V. V. BOGOMOLOV (Institut Mediko-Biologicheskikh Problem, Moscow, USSR) (IAA, IAF, AN

SSSR, et al., Symposium on Man in Space, 8th, Tashkent, Uzbek SSR, Sept. 29-Oct. 3, 1990) Acta Astronautica (ISSN 0094-5765), vol. 23, 1991, p. 153-156.

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The paper presents the theoretical prerequisites and validation of medical rehabilitation of the cosmonauts following space missions developed on the basis of complex experimental studies and space medicine experience. The main phenomenological manifestations of readaptation and the tasks of stepwise recovery are described. Readaptation changes in the body state are considered, on the one hand, as a consequence of the microgravity effect and, on the other hand, as the adaptation manifestations to 1 g occurring on earth. The principles of and approaches to performing rehabilitative measures, as well as dosages and sequences of their applications at early and subsequent stages of readaptation (including sanatorium treatment), are presented. An individualization of specific programs of rehabilitative-and-therapeutic measure is of great importance. Author

#### A91-23449

##### **+GX-TOLERANCE IN THE FINAL STAGE OF SPACE FLIGHTS OF VARIOUS DURATIONS**

A. R. KOTOVSKAIA and I. F. VIL'-VIL'AMS (Institut Mediko-Biologicheskikh Problem, Moscow, USSR) (IAA, IAF, AN SSSR, et al., Symposium on Man in Space, 8th, Tashkent, Uzbek SSR, Sept. 29-Oct. 3, 1990) Acta Astronautica (ISSN 0094-5765), vol. 23, 1991, p. 157-161. refs

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A study is carried out on human G tolerance at the final stage of space flights of various durations aboard the Soyuz-T and Soyuz-TM spacecraft, and an assessment is made of the antigravity protection under the aforementioned conditions. The cosmonauts' tolerance to accelerations is analyzed for 38 space missions of duration 8-326 days. The acceleration tolerance during descent in all cases is estimated as satisfactory. The acceleration tolerance during the final stage of orbital flight is found to depend on the flight duration, individual tolerance, and use of countermeasures. S.A.V.

A91-23457\* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.

##### **RADIOLOGICAL HEALTH RISKS FOR EXPLORATORY CLASS MISSIONS IN SPACE**

D. STUART NACHTWEY (NASA, Johnson Space Center, Houston, TX) and TRACY CHUI-HSU YANG (California, University, Berkeley). (IAA, IAF, AN SSSR, et al., Symposium on Man in Space, 8th, Tashkent, Uzbek SSR, Sept. 29-Oct. 3, 1990) Acta Astronautica (ISSN 0094-5765), vol. 23, 1991, p. 227-231. refs

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The radiation risks to crewmembers on missions to the moon and Mars are studied. A graph is presented of the cross section as a function of linear energy transfer (LET) for cell inactivation and neoplastic cell transformation. Alternatives to conventional approaches to radiation protection using dose and Q are presented with attention given to a hybrid of the conventional system for particles with LET less than 100 keV/micron. K.K.

A91-23509\* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.

##### **CHANGES IN BODY FLUID COMPARTMENTS DURING A 28-DAY BED REST**

SUZANNE M. FORTNEY, KENNETH H. HYATT, JOHN E. DAVIS, and JOHN M. VOGEL (NASA, Johnson Space Center, Houston, TX) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 62, Feb. 1991, p. 97-104. refs. (Contract NASA ORDER T-68099)

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Serial isotope measurements were used to obtain measurements of the body fluid responses of 10 22-29-year-old men during 28 d of simulated microgravity (bed rest). The subjects were maintained on a controlled metabolic diet for 7 d before the study, during 14 d of ambulatory control, 28 d of horizontal bed

rest, and 14 d of ambulant recovery. Fluid compartments were measured on control days 1 and 9, bed rest days 2, 14, and 28, and recovery days 7 and 14. By day 2 of bed rest, plasma volume and extracellular volume (ECV) decreased significantly by an average 209 and 533 ml, respectively. Red cell volume and total body water (TBW) decreased more slowly, with average losses of 128 and 1316 ml, respectively, after 28 d of bed rest. Early in the bed rest, TBW loss was mostly from the ECV. Thereafter, the TBW deficit was derived from the intracellular compartment, which decreased an average of 838 ml after 28 d. These results suggest losses from all fluid compartments during bed rest, with no evidence of restoration of ECV after 1-2 weeks. Author

#### A91-23510

##### **PROPRANOLOL FAILS TO LOWER THE INCREASED BLOOD PRESSURE CAUSED BY COLD AIR EXPOSURE**

H. L. REED, K. R. KOWALSKI, M. M. D'ALESSANDRO, R. ROBERTSON, and S. B. LEWIS (U.S. Navy, Naval Medical Research Institute, Bethesda, MD) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 62, Feb. 1991, p. 111-115. Research supported by the U.S. Navy. refs

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Cold air exposure stimulates a rise in mean arterial blood pressure (MAP) and plasma norepinephrine (NE). The specific contribution of the beta-adrenergic receptor to this pressor response is unknown. Therefore, 12 normal men were pretreated with placebo or a bradycardia-inducing amount of propranolol prior to exposing them to either 25 C or 4 C air. At 25 C, propranolol pretreatment lowered heart rate and MAP. When changes in MAP were compared after their respective 30-min exposure at 25 C and 4 C, the cold elevated MAP by 18.4 + or - 1.5 mm Hg in subjects pretreated with propranolol compared with 13.0 + or - 2.5 mm Hg in subjects pretreated with placebo. Fingertip skin temperature measured at 4 C, 9.5 + or - 0.8 C in propranolol-pretreated subjects was lower than the 11.1 + or - 0.7 C with that of placebo group. Plasma NE increased equally during cold exposure with both placebo and propranolol pretreatment. It is concluded that the beta receptor plays a minor role in generating the pressor response to cold air. Therefore, the effectiveness of acute administrations of propranolol for maintaining normotension in subjects exposed to cold environments may be attenuated. Author

#### A91-23512

##### **EFFECTS OF WATER IMMERSION ON CARDIAC OUTPUT OF LEAN AND FAT MALE SUBJECTS AT REST AND DURING EXERCISE**

AL-SAID A. HAFFOR, JOHN G. MOHLER (Southern California, University, Los Angeles, CA), and ABNER C. HARRISON (Mississippi State University, Mississippi State) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 62, Feb. 1991, p. 123-127. refs

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#### A91-23513

##### **UNPREDICTABILITY OF FIGHTER PILOT G TOLERANCE USING ANTHROPOMETRIC AND PHYSIOLOGIC VARIABLES**

JAMES T. WEBB, CAROLYN J. OAKLEY, and LARRY J. MEEKER (Krug International, San Antonio; USAF, School of Aerospace Medicine, Brooks AFB, TX) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 62, Feb. 1991, p. 128-135. refs

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Correlation and regression analyses were used to study relationships between centrifuge G tolerances of 1434 fighter pilots during high-G Training (HGT) and anthropometric and physiologic variables. Multiple regression analyses yielded a four-variable model in which gradual onset run (GOR) relaxed-G tolerance was inversely correlated with height and directly correlated with age, weight, and diastolic blood pressure. Although the four-variable model was able to predict more of the variation in G tolerance than any single variable, neither method showed a correlation (r) of greater than 0.35 with GOR relaxed or straining G tolerance. No subject variable was significantly different between the pilot groups that

did and did not experience G-induced loss of consciousness. It is concluded that prediction of G tolerance during centrifuge HGT is unreliable using anthropometric and physiologic variables. The anti-G straining maneuver remains the major determinant of an individual's G tolerance. Author

#### A91-23514

##### LOCOMOTION AND MOTION SICKNESS DURING HORIZONTALLY AND VERTICALLY REVERSED VISION

MASAHITO TAKAHASHI, AKIRA SAITO, YUKIHIRO OKADA, YASUHIKO TAKEI, IKUKO TOMIZAWA (Keio University, Tokyo, Japan) et al. Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 62, Feb. 1991, p. 136-140. refs  
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Locomotion and motion sickness during reversed vision were studied in ten normal subjects and a patient with bilateral labyrinthine loss. Whereas horizontal reversal produced moderate to severe gait disturbances as well as motion sickness in all normal subjects, vertical reversal failed to induce such symptoms. The patient, being free of motion sickness during both reversals, could not walk straight during horizontal reversal. The difference in the strength of sensory mismatch between both directions seemed to result from a difference in the role of vision for spatial orientation which is produced by the proprioceptive as well as otolithic inputs of gravity. Author

#### A91-23515

##### MOTION SICKNESS SEVERITY UNDER INTERACTION OF VECTION AND HEAD MOVEMENTS

TIANDE YANG and JINGSHEN PEI (Institute of Space Medico-Engineering, Beijing, People's Republic of China; York University, North York, Canada) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 62, Feb. 1991, p. 141-144. refs  
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This study's purpose was to observe how different combinations of vection and head movements influenced the severity of motion sickness (MS). Twenty-six subjects were tested in a rotating sphere at a speed of 45 deg/s, resulting in vertical yaw, horizontal roll, or pitch vection. Coincidentally, subjects pitched, rolled, or yawed their heads (0.5 Hz, 20 deg). It was found that yaw vection combined with pitch or roll head movements significantly increased MS, while pitch vection with any type of head movement, or head and scene rotation about the same axis significantly reduced MS. When the head was kept stationary, pitch vection was most stressful for MS, followed by roll vection, then yaw vection, although yaw vection was the strongest sensation of self-rotation. Author

#### A91-23516

##### THE INTERACTION OF HAND VIBRATION WITH OCULOMANUAL COORDINATION IN PURSUIT TRACKING

B. J. MARTIN, N. DI RENZO (Institut National de Recherche et de Securite pour la Prevention des Accidents du Travail et des Maladies Professionnelles, Vandoeuvre, France), and J. P. ROLL (Aix-Marseille I, Universite, Marseille, France) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 62, Feb. 1991, p. 145-152. Research supported by the Institut National de Recherche et de Securite pour la Prevention des Accidents du Travail et des Maladies Professionnelles and Ministere de l'Environnement of France. refs  
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The effect of high-frequency (150 Hz) vibration applied to the hand on the coordinated eye and hand tracking movements during the pursuit tracking process was investigated in trained human subjects. In experiments, a zero-order pursuit tracking task was first performed with and without direct visual control of the hand, followed by an experiment in which an imaginary target linked to the hand was tracked using the same experimental setup. It was found that, when hand was out of sight, the hand vibration significantly altered the eye and hand tracking performances, but that the effect was less pronounced when the hand was placed in the visual field. The results suggest that the eye and the hand

tracking systems are synchronized by a common mechanism and that direct visual control of the hand can partially compensate for the performance alteration caused by hand vibration. I.S.

#### A91-23519

##### POST-EXERCISE TIME-COURSE ANALYSIS OF ST SEGMENT AND T WAVE CHANGES - AN IMPORTANT CONTRIBUTION TO THE ROLE OF STRESS ELECTROCARDIOGRAPHY IN AIRCREW

C. W. BARLOW, E. R. SOICHER, J. B. BARLOW, B. M. FRIEDMAN, D. P. MYBURGH (Institute of Aviation Medicine, Pretoria; South African Airways; Witwatersrand, University; Johannesburg Hospital, Republic of South Africa) et al. Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 62, Feb. 1991, p. 165-171. refs  
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Flight surgeons recognize that ongoing vigilance is necessary to detect coronary artery disease (CAD) in aircrew. Regular physical examinations with only a resting electrocardiogram, albeit having a very low predictive value for detection of CAD in asymptomatic subjects, are now widely practiced. Routine stress electrocardiography has been criticized for yielding too many so-called 'false positive' results because ST/T changes that develop during and after exercise are prevalent. Recent studies in this institution indicate, however, that the time-course behavior patterns of these ST/T configurational 'abnormalities' after exercise are different from those reflecting myocardial ischemia due to epicardial CAD. Time-course analysis increases the predictive value of exercise testing and has dramatically decreased the number of asymptomatic aircrew being subjected to coronary arteriography. Routine exercise electrocardiography provides a reliable, cost-effective means of detecting aircrew with CAD and a baseline for comparison at subsequent examination. Author

#### A91-23520 North Carolina Univ., Greensboro.

##### A STATISTICAL NOTE ON THE REDUNDANCY OF NINE STANDARD BAROREFLEX PARAMETERS

DAVID A. LUDWIG (North Carolina, University, Greensboro) and VICTOR A. CONVERTINO (NASA, Kennedy Space Center, Cocoa Beach, FL) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 62, Feb. 1991, p. 172-175. Research supported by the American Society for Engineering Education. refs  
(Contract NGT-60002)  
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An accepted method for measuring the responsiveness of the carotid-cardiac baroreflex to arterial pressure changes is to artificially stimulate the baroreceptors in the neck with a pressurized neck chamber. Nine physiological responses to this type of stimulation are quantified and used as indicators of the baroreflex response function. Thirty male humans between the ages of 27 and 46 underwent the carotid-cardiac baroreflex test. The data for the nine response parameters were analyzed by principle component factor analysis. The results indicated that 92.5 percent of the total variance across all nine parameters could be explained in four dimensions. The first two dimensions reflected location points for R-R interval and carotid distending pressure, respectively. The third factor was composed of measures reflecting the gain (responsiveness) of the reflex. The fourth dimension was the ratio of baseline R-R interval to the maximal R-R interval response during simulated hypertension. The data suggest that the analysis of all nine baroreflex parameters is likely to be redundant and researchers should account for these redundancies either in their analyses or conclusions. Author

#### N91-15675 Tel-Aviv Univ. (Israel). Dept. of Computer Science.

##### A TWO PHASE ALGORITHM FOR AUTOMATIC CLASSIFICATION OF CHROMOSOMES M.S. Thesis

DORON EZRA Aug. 1988 88 p In HEBREW; ENGLISH summary  
(ITN-90-85039) Copyright Avail: Tel-Aviv Univ., Exact Sciences Library, Ramat Aviv 69778, Israel

The aim was to develop an algorithm to classify chromosomes more effectively and simply than the currently available Karotype systems some of which achieve 90 percent success in identification.



Small computers are to be used. Working assumptions were: input must be uniform regarding the supplying laboratory and the type of test (blood, amniotic fluid, etc.); the classification must be based on the system's own study and analysis of the data; the system must include apparatus for automatic measurement of the properties used in classification; the algorithm must be partly based on statistical analysis of the data. The chosen algorithm uses a 2-phase classification process. The first phase groups 24 chromosome types according to chromosome length and centromer position. The second phase uses the density profile to describe the chromosome internal structure and complete the classification within the main groups. A clustering algorithm was used for the first phase. An algorithm which uses several weighting functions to analyze the density profile was used for the second phase. A final classification algorithm was used which uses the multivariate normal density function model. The algorithms were applied to a KARYOTEC 100 system, developed by Amcor Electronics. Tests were run on data from 31 normal cells, taken for testing amniotic fluid and which contained 1135 chromosomes. The results confirmed expectations. The classification achieved an overall 88 percent success level, and was almost 100 percent successful in the separation of chromosomes into main groups. ISA

**N91-15676** Tel-Aviv Univ. (Israel). Dept. of Biomedical Engineering.

### **ESTIMATION OF EVOKED POTENTIALS M.S. Thesis**

ABRAHAM BLAU Jan. 1989 131 p In HEBREW; ENGLISH summary

(ITN-90-85060) Copyright Avail: Tel Aviv Univ., Exact Sciences Library, Ramat Aviv 69978, Israel

Evoked potentials are biological potentials set up in the body in response to an external stimulus. Methods to average out the background noise in measurements of evoked potentials were studied and developed. The study of weighting algorithms, which inversely relate measurement weighting to the measured noise level, comprised theoretical background, case studies and simulation. Weighting methods were found to be generally effective, especially when the noise power varied during the experiment. Study of the development of a noise filter, based on a priori knowledge of the noise and signal spectra included a critical review of the available literature and the development of a new algorithm, based on A Posteriori Optimal Filtering (APOF). The optimal filter calculation uses estimations of the signal and noise autocorrelations. Guidelines adopted for APOF development included: minimal a priori assumptions; the possibility of on-line use of the method; and a desired waiting period of no more than a few seconds, for the estimated evoked potential value. Evaluation of APOF performance was based on laboratory measurements and simulated data; it was compared with the average method and with A Posteriori Wiener Filtering (APWF), which operates in the frequency domain. The main conclusions were: that the APOF estimator is better than the average estimator in most cases; that APOF is a little better than APWF; that APOF performance falls off with increasing number of measurements, owing to the assumption that the signal is a stationary process; and that APOF can be easily generalized to include the case of non-stationary processes. A time-varying optimal filter in the time domain is suggested as a method for improving the performance of APOF in the case of non-stationary evoked potentials. ISA

**N91-15677#** Maryland Univ., College Park.

### **SIGNAL PROCESSING AND RECOGNITION IN ADAPTIVE**

**NEURAL NETWORKS Annual Report No. 2, 1 Aug. 1989 - 31 Jul. 1990**

SHIHAB SHAMMA and P. S. KRISHNAPRASAD 9 Aug. 1990 6 p

(Contract AF-AFOSR-0204-88; AF PROJ. 2313)

(AD-A226828; AFOSR-90-0964TR) Avail: NTIS HC/MF A02 CSCI 06/4

This research can be subdivided into four areas: (1) Models and neurophysiology of the auditory cortex. This includes mappings of physiological responses to sound, psychoacoustical studies, and mathematical models of the data. (2) Implementations of the

cochlear and other auditory models both in digital signal processing and very large scale integration forms. (3) Unsupervised learning algorithms applied to problems in sound segmentation, timbre characterization, and pitch extraction. (4) Applications of wavelet transforms to the analysis of neural networks. GRA

**N91-15678#** Naval Aerospace Medical Research Lab., Pensacola, FL.

### **VESTIBULAR STIMULATION DURING A SIMPLE CENTRIFUGE RUN Interim Report**

F. E. GUEDRY and C. M. OMAN (Massachusetts Inst. of Tech., Cambridge.) May 1990 19 p Sponsored by Naval Medical Research and Development Command, Bethesda, MD (AD-A227285; NAMRL-1353) Avail: NTIS HC/MF A03 CSCI 20/11

Vestibular stimuli throughout a simple centrifuge run are described. Vestibular transduction is examined. Herein, stimuli throughout the initial angular acceleration with stimuli during the deceleration that ends the run are compared. Tables are provided that show differing rates of change of linear and angular acceleration vectors during the acceleration and deceleration, and the research steps needed to explain disorientation abhorrence reactions and spatial orientation perceptions in centrifuge runs are discussed. GRA

**N91-15679#** Idaho National Engineering Lab., Idaho Falls.

### **HUMAN SYSTEM INTERACTION MEASURES: AN APPROACH TO IMPROVE SYSTEM PERFORMANCE**

HAROLD S. BLACKMAN 1990 5 p Presented at the Probabilistic Safety Assessment and Management, Beverly Hills, CA, 4-7 Feb. 1991

(Contract DE-AC07-76ID-01570)

(DE91-001827; EGG-M-90350; CONF-910213-14) Avail: NTIS HC/MF A01

This paper presents an approach for the analysis of system performance. This approach is based upon a functional model of the system, and performance measures of that system. The paper also presents a model of total system performance which is composed of the following three parts: challenges (the challenge represented by the scenario), functions (the resources available to be applied to the challenge), and sequence (how resources are used to cope with the challenge). The approach and model are applied and presented in a civil aviation application. DOE

**N91-15680#** Los Alamos National Lab., NM. Physical Div.

### **NONINVASIVE STUDIES OF HUMAN VISUAL CORTEX USING NEUROMAGNETIC TECHNIQUES**

C. J. AINE, J. S. GEORGE, S. SUPEK, and E. L. MACLIN (Veterans Administration Hospital, Albuquerque, NM.) 1990 4 p Presented at the Conference on Noninvasive Assessment of the Visual System, Santa Fe, NM, 4-7 Feb. 1991

(Contract W-7405-ENG-36)

(DE91-001856; LA-UR-90-3634; CONF-910245-1) Avail: NTIS HC/MF A01

The major goals of noninvasive studies of the human visual cortex are: to increase knowledge of the functional organization of cortical visual pathways and to develop noninvasive clinical tests for the assessment of cortical function. Noninvasive techniques suitable for studies of the structure and function of human visual cortex include magnetic resonance imaging (MRI), positron emission tomography (PET), single photon emission tomography (SPECT), scalp recorded event-related potentials (ERPs), and event-related magnetic fields (ERFs). The primary challenge faced by noninvasive functional measures is to optimize the spatial and temporal resolution of the measurement and analytic techniques in order to effectively characterize the spatial and temporal variations in patterns of neuronal activity. In this paper we review the use of neuromagnetic techniques for this purpose. DOE

**N91-15681#** Los Alamos National Lab., NM. Complex Systems Group.

### **NONLINEAR DYNAMICS OF NEURAL DELAYED FEEDBACK**

ANDRE LONGTIN 1990 17 p Presented at the SFI Studies in the Sciences of Complexity Conference, Santa Fe, NM, 4-29 Jun. 1990 Submitted for publication Sponsored in part by Natural Sciences and Engineering Research Council, Canada (Contract W-7405-ENG-36) (DE91-001864; LA-UR-90-3562; CONF-9006289-1) Avail: NTIS HC/MF A03

Neural delayed feedback is a property shared by many circuits in the central and peripheral nervous systems. The evolution of the neural activity in these circuits depends on their present state as well as on their past states, due to finite propagation time of neural activity along the feedback loop. These systems are often seen to undergo a change from a quiescent state characterized by low level fluctuations to an oscillatory state. We discuss the problem of analyzing this transition using techniques from nonlinear dynamics and stochastic processes. Our main goal is to characterize the nonlinearities which enable autonomous oscillations to occur and to uncover the properties of the noise sources these circuits interact with. The concepts are illustrated on the human pupil light reflex (PLR) which has been studied both theoretically and experimentally using this approach. DOE

**N91-15682\*** Massachusetts Inst. of Tech., Cambridge. Man Vehicle Lab.

**ANALYSIS OF OCULAR TORSION DATA FROM SPACE LABS D-1 AND SL-1 Final Report**

C. M. OMAN Dec. 1990 14 p (Contract NAGW-1377) (NASA-CR-187799; NAS 1.26:187799) Avail: NTIS HC/MF A03 CSDL 06/16

A series of preflight, inflight, and postflight vestibular experiments were conducted on Spacelab missions SL-1 and D-1. Two portions of the investigation, the 'sled' and 'dome' functional objectives, involved recording the torsional motion of human subject's eyes. In the SL-1 sled and dome experiments, preflight and postflight ocular torsion was recorded on 35 mm film using a Nikon motor driven camera (2.6 frames/sec). The film was to be analyzed by measuring the motion of contact lens landmarks using a Hermes senior film scanner. However, an inflight failure of the dome experiment camera flash unit led the crew to utilize the Spacelab video camera as an alternative contingency method for imaging the eye in this FO. A suitable method for analysis of the video data was developed. Results of the analysis are presented.

Author

**N91-15683#** Technion - Israel Inst. of Tech., Haifa. Inst. of Biomedical Engineering.

**CEREBRAL-BODY PERFUSION MODEL Annual Report, Nov. 1988 - Apr. 1990**

S. SOREK (Ben Gurion Univ. of the Negev, Sede Boqer, Israel), J. BEAR, M. FEINSOD, K. ALLEN, and L. BUNT Jul. 1990 84 p

(Contract AF-AFOSR-0054-89) (AD-A227851; EOARD-TR-90-09; SR-4) Avail: NTIS HC/MF A05 CSDL 06/4

A lumped parameter model is developed to focus on the dynamic flow and pressure interactions between the cerebral, cardiovascular, and the respiratory systems. The interrelated pressures and fluxes are excited by left cardiac pressure, by expiration/inspiration fluxes and by pressure exerted on the abdomen. Sensitivity analysis examines changes in pressure and flux at the cerebral carotid arteries and capillaries resulting from a sudden rise to an upright position, changes in inhale/exhale patterns, pressurizing the abdomen, changes in gravity acceleration, changes in blood viscosity, and heart frequency. Animal experiments are performed to validate model predictions and to enable parameter estimations.

GRA

**N91-16542#** Brookhaven National Lab., Upton, NY. Atomic and Applied Physics Group.

**GALLIUM AS A UNIQUE ANTI-RESORPTIVE AGENT IN BONE: PRECLINICAL STUDIES ON ITS MECHANISMS OF ACTION**  
RICHARD BOCKMAN, ROBERT ADELMAN, ROBERT DONNELLY,

LYNN BRODY, RAYMOND WARRELL (Hospital for Special Surgery, New York, NY.), and KEITH W. JONES 1990 8 p Presented at the 1st International Symposium on Metal Ions in Biology and Medicine, Champagne, France, 16-19 May 1990 Sponsored in part by Department of Health and Human Services, Washington, DC

(Contract DE-AC02-76CH-00016; NIH-RR-01838) (DE90-010650; BNL-44536; CONF-9005170-1) Avail: NTIS HC/MF A02

The discovery of gallium as a new and unique agent for the treatment of metabolic bone disorders was in part fortuitous. Gallium is an exciting new therapeutic agent for the treatment of pathologic states characterized by accelerated bone resorption. Compared to other therapeutic metal compounds containing platinum or germanium, gallium affects its antiresorptive action without any evidence of a cytotoxic effect on bone cells. Gallium is unique amongst all therapeutically available antiresorptive agents in that it favors bone formation. DOE

**N91-16543** New South Wales Univ., Canberra (Australia).

**ELECTRICAL RESISTANCE VOLUMETRY IN THE CIRCULATION Ph.D. Thesis - 1988 Abstract Only**

JOHN CAMPBELL WOODARD 1 Jun. 1990 3 p Avail: Issuing Activity

The measurement of changes in blood volume is examined using electrical resistance techniques. The utility of such cardiovascular measurements was assessed for use with implantable devices. Intracardiac measurements were made in both greyhound dogs and human volunteers with an 8-electrode catheter which was also used for intravascular resistance measurements. Transcardiac resistance of greyhound hearts was obtained from epicardial electrodes used with implantable defibrillators. These in-vivo experiments were supplemented with in-vitro investigations using canine tissues and computer simulation, to determine the geometric factors influencing the performance of the conductance catheter and the magnitude of changes in tissue resistivity under various conditions. Good transduction of ventricular volume change was obtained from the multi-electrode catheter in the right ventricle under a variety of interventions. However anatomical factors, principally the location of the tricuspid valve, limited the proportion of the ventricle that could be effectively transduced and necessitated careful positioning of the catheter to obtain acceptable volume transduction. Computer simulation and in-vitro measurements showed that the radial position of the catheter in a vessel of constant cross-section could result in errors in volume measurement, and that this error could be minimized by a large separation of the current-injecting electrodes. Transcardiac resistance was found to be unrelated to ventricular volume changes, but was strongly associated with the level of coordinated mechanical activity of the heart. Both transcardiac resistance and volume measurements from a right ventricular catheter appear suitable for detection of ventricular fibrillation. Although volume transduction using a right ventricular catheter is subject to error during arrhythmias, this technique could be used for rate-regulation of an artificial pacemaker. Author

**N91-16544#** Federal Aviation Administration, Washington, DC. Office of Aviation Medicine.

**THE USE OF CONTACT LENSES IN THE CIVIL AIRMAN POPULATION Final Report**

VAN B. NAKAGAWARA Sep. 1990 15 p (AD-A227450; DOT/FAA/AM-90/10) Avail: NTIS HC/MF A03 CSDL 06/4

Federal Aviation Regulations permit the routine use of contact lenses by civilian pilots to satisfy the distant visual acuity requirements for obtaining medical certificates. Specific information identifying the prevalence of both defective distant vision and contact lenses in the civil airman population is required to guide future medical certification decisions, policy changes, and education safety programs for aviation personnel. A descriptive, retrospective epidemiologic study was performed of active airmen by 5-year intervals for a 20-year period (1967 to 1987) using FAA databases and publications. The percentage of airmen who use contact lenses



quadrupled during the study period. When stratified by class of medical certificate and age, the prevalence rates for airmen with first-class medical certificates and older airmen showed the largest increases. The increasing use of contact lenses and the variety of design, materials, and applications which may be employed by the pilot population mandate ongoing review for adverse changes and safety consequences. GRA

**N91-16545#** Army Research Inst. of Environmental Medicine, Natick, MA.

**QUANTIFICATION OF LOWER BOUNDS FOR ENDURANCE TIMES IN THERMALLY INSULATED FINGERS AND TOES EXPOSED TO COLD STRESS**

AVRAHAM SHITZER, LEANDER A. STROSCHEIN, WILLIAM R. SANTEE, RICHARD R. GONZALES, and KENT B. PANDOLF Jul. 1990 56 p

(Contract DA PROJ. 3E1-62787-A-878)

(AD-A227782; USARIEM-T18-90) Avail: NTIS HC/MF A04

CSSL 06/5

The model developed is useful in calculating temperature variations along insulated digits and in predicting their endurance times to cold exposures. Calculated results compared very favorably with data obtained on human subjects. The present version of the model does not include the effect of cold induced vasodilation. Expansion of the model to include this important natural mechanism will tend, as a general rule, to predict longer, less conservative endurance times. Thus, predictions based on the present model should be useful whenever conservative, lower bounds of endurance times to cold exposures are required.

GRA

**N91-16546#** California Univ., Berkeley. Lawrence Berkeley Lab. Theoretical Physics Group.

**A QUANTUM THEORY OF THE MIND-BRAIN INTERFACE**

HENRY P. STAPP 30 Jul. 1990 35 p Presented at the Conference on Consciousness Within Science, San Francisco, CA, 17-18 Feb. 1990

(Contract DE-AC03-76SF-00098)

(DE91-004431; LBL-28574; CONF-9002159-1) Avail: NTIS HC/MF A03

The Heisenberg quantum mechanical conception of nature is extended and applied to the brain. Strict adherence to the principle of parsimony, and to quantum thinking, produces naturally, on the basis of an overview of brain operation compatible with the information provided by the brain sciences, a unified description of the physical and mental aspects of nature that can account in principle for the full content of felt human experience. DOE

**N91-16547\*** National Aeronautics and Space Administration, Washington, DC.

**AEROSPACE MEDICINE AND BIOLOGY: A CUMULATIVE INDEX TO A CONTINUING BIBLIOGRAPHY (SUPPLEMENT 345)**

Jan. 1991 233 p

(NASA-SP-7011(345); NAS 1.21:7011(345)) Avail: NTIS HC A11; NTIS standing order as PB91-912300, \$15.00 domestic, \$30.00 foreign CSSL 06/5

This publication is a cumulative index to the abstracts contained in Supplements 333 through 344 of Aerospace Medicine and Biology: A Continuing Bibliography. Seven indexes are included -- subject, personal author, corporate source, foreign technology, contract number, report number, and accession number. Author

**N91-16554#** Institute of Aviation Medicine, Farnborough (England).

**CEREBRAL OXYGEN STATUS AND G-INDUCED LOSS OF CONSCIOUSNESS**

DAVID H. GLAISTER In AGARD, Safety Network to Detect Performance Degradation and Pilot Incapacitation 4 p Sep. 1990

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G-induced loss of consciousness (G-LOC) is a common event

and has led to the loss of many aircraft and aircrew. While most body systems are ultimately affected, the final common path for its initiation is an inadequate supply of oxygen to the brain. Thus, a measure of cerebral oxygen sufficiency could provide a specific monitor for incipient G-LOC and serve either as a warning to the pilot or as a trigger for an autorecovery system. Multiwavelength near IR spectrophotometry permits the noninvasive in vivo measurement of the oxygen content of blood within the cerebral microcirculation, and also of the oxygen status of cytochrome-c oxidase within the brain cells. This technique was validated in human subjects during exposure to hypoxia; in presyncope induced by lower body negative pressure; and during +G sub z induced loss of consciousness. As well as providing an important new tool for acceleration research, the technique has the potential to be developed into an inflight monitor for aircrew. Author

**N91-16555#** Laboratoire de Medecine Aerospatiale, Bretigny-sur-Orge (France).

**DETECTION OF LOSS OF CONSCIOUSNESS IN FLIGHT BY DOPPLER METHOD [DETECTION DES PERTES DE CONNAISSANCE EN VOL PAR METHODE DOPPLER]**

J. M. CLERE, G. OSSARD, D. LEJEUNE, A. LEGER, and A. RONCIN (Tours Univ., France) In AGARD, Safety Network to Detect Performance Degradation and Pilot Incapacitation 6 p Sep. 1990 In FRENCH

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The use of transcranial Doppler monitoring is recommended for detecting acceleration induced loss of consciousness (LOC). One transcranial Doppler pulse device was developed specifically to function in a centrifuge and another for use in a Mirage 2000, causing limitations to respect the secure environment required by use in flight. During a study conducted for the evaluation of acceleration tolerance of 9 subjects at +8 Gz, the transcranial Doppler device showed the existence in 23 instances of a relationship between velocimetric signal reduction of an average cerebral arterial circulation and the decrease of the field of view; in 9 instances, this relationship was not observed; and in 1 case a weak decrease of the Doppler signal was followed by LOC. The detection and analysis of LOC in flight of many physiological and flight factors will cause the release of automatic safety procedures by the onboard computer. This necessitates the development of new and complex procedures. In this case, the best treatment for LOC consist of being put in a preventive position thanks to new anti-G protection (inclined seat, positive pressure respiration, anti-G pants for the lower body). Transl. by E.R.

## 53

### BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

**A91-20675**

**SELECTION AND TRAINING OF COMMERCIAL PILOTS; PROCEEDINGS OF THE CONFERENCE, LONDON, ENGLAND, MAY 4, 1989**

Conference sponsored by the Royal Aeronautical Society. London, Royal Aeronautical Society, 1989, 68 p. No individual items are abstracted in this volume.

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Topics presented include the principles of objective selection, airline pilot selection, one company's approach to professional helicopter pilot training, and the requirements of the pilot's license. Also presented are how the professional school addresses the pilot's license requirements and the development of the young pilot within the airline. R.E.P.

A91-21800

**THE APPLICATION OF PSYCHOMOTOR TESTING IN THE UNITED STATES AIR FORCE**

KEVIN J. PAULSON (USAF, Vance AFB, OK) Aeromedical and Training Digest, vol. 5, Jan. 1991, 3 p. refs  
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A review is presented of the use of psychomotor testing in the USAF as applied to pilot selection candidacy for flight training. Currently, the goal of psychomotor testing is to improve the pilot selection methods by identifying those people who have an excellent chance both of finishing training and of becoming highly successful operational pilots. Psychomotor testing principally comprises performance tests which are used to assess the motor skills of an individual. The skills that are tested include manipulative, coordinative, repetitive, and/or precise limb or body movements that include multilimb coordination, wrist-finger speed, and manual dexterity. Some of the test examples are described and preliminary test conclusions are discussed. R.E.P.

A91-22194#

**AN ANTARCTIC CROSSING AS AN ANALOGUE FOR LONG-TERM MANNED SPACEFLIGHT**

H. URSIN (Bergen, Universitetet, Norway), J. COLLET (ESA, Directorate of Space Station and Microgravity, Paris, France), and JEAN-LOUIS ETIENNE ESA Bulletin (ISSN 0376-4265), no. 64, Nov. 1990, p. 44-49.  
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In 1988 the Long-Term Program Office (LTPO) of the ESA Directorate of Space Station and Microgravity established an intellectual infrastructure to collaborate with scientific experts in the field, and to perform exploratory studies on human factors. Among the challenges encountered during manned space missions are isolation, a hostile environment, danger, confinement, and the difficulties of a small group living together in close proximity for long periods. In the framework of the European Manned Space Infrastructure studies, the LTPO has performed investigations in some of these areas. This paper details the lessons learned from the Transantarctica expedition which took place from July 27, 1989 to March 3, 1990. It involved crossing the Antarctic from the Peninsula to the South Pole, to the Soviet Vostok base, and then to the Mirny base. The 5763-km trip was completed successfully by six men on skis and a team of dogs pulling equipment on sledges. L.K.S.

A91-23438

**MOTOR SKILLS UNDER VARIED GRAVITATIONAL FORCE IN PARABOLIC FLIGHT**

HELEN E. ROSS (Stirling, University, Scotland) (IAA, IAF, AN SSSR, et al., Symposium on Man in Space, 8th, Tashkent, Uzbek SSR, Sept. 29-Oct. 3, 1990) Acta Astronautica (ISSN 0094-5765), vol. 23, 1991, p. 85-95. Research supported by the Medical Research Council, British Aerospace, PLC, Royal Society, et al. refs

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Parabolic flight produces brief alternating periods of high and low gravitational force. Subjects were tested on various paper-and-pencil aiming and tapping tasks during both normal and varied gravity in flight. It was found that changes in g level caused directional errors in the z body axis (the gravity axis), the arm aiming too high under 0g and too low under 2g. The standard deviation also increased for both vertical and lateral movements in the mid-frontal plane. Both variable and directional errors were greater under 0g than 2g. In an unpaced reciprocal tapping task subjects tended to increase their error rate rather than their movement time, but showed a non-significant trend towards slower speeds under 0g for all movement orientations. Larger variable errors or slower speeds were probably due to the difficulty of re-organizing a motor skill in an unfamiliar force environment, combined with anchorage difficulties under 0g. Author

A91-23517\* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.

**AIRCREW DECISION-MAKING BEHAVIOR IN HAZARDOUS WEATHER AVOIDANCE**

ALFRED T. LEE (NASA, Ames Research Center, Moffett Field, CA) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 62, Feb. 1991, p. 158-161. refs  
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A study was conducted to assess the situation awareness and decision-making behavior of aircrews in a line-oriented simulation of the microburst/windshear encounter which occurred on July 11, 1988, at the Denver Stapleton Airport as affected by the manner in which information available at different times and in different forms. Intracrew communications and approach-to-land decisions were evaluated with conventional ATC communications and with automated cockpit alerting and display of weather information. It was found that the avoidance decision-making performance of aircrews provided only with conventional ATC transmissions of weather information was significantly less efficient than the performance of crews provided with a visual display of microburst events. I.S.

A91-23518

**PRIMARY FLIGHT TRAINING PERFORMANCE OF STUDENT NAVAL AVIATORS WITH VISION WAIVERS**

BRUCE BOHNER, FANANCY ANZALONE, MICHAEL MITTELMAN, and ANDREW MARKOVITS (U.S. Navy, Naval Aerospace Medical Institute, Pensacola, FL) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 62, Feb. 1991, p. 162-164. refs  
Copyright

Performance was studied for student naval aviators with waivers for defective uncorrected distance visual acuity who underwent primary flight training at NAS Whiting Field, FL, for fiscal year 1987 (cases = 45). Outcome variables were completion rate, primary flight training grades and flight hours. Controls for completion rate were all other students during that period (N = 1443). For training grades and hours, controls were selected who completed the same training squadron within one month of the case. Two controls were selected who progressed to the jet pipeline, with two additional controls selected who progressed to the same pipeline as the cases, either maritime/patrol or helicopter (controls = 180). Results demonstrated the cases were significantly more likely to complete training (p = 0.029), but not significantly different in primary flight grades or hours. These results suggest student naval aviators on vision waivers were competitive with their contemporaries. Author

N91-15684# Department of the Navy, Washington, DC.

**A SCHEINER-PRINCIPLE POCKET OPTOMETER FOR SELF EVALUATION AND BIO-FEEDBACK ACCOMMODATION TRAINING Patent Application**

WILLIAM B. CUSHMAN, inventor (to Navy) 28 Feb. 1990 17 p (AD-D014579; US-PATENT-APPL-SN-486323) Avail: NTIS HC/MF A02 CSCL 06/5

The present invention relates to optometers and particularly to a Scheiner-principle optometer apparatus, and method therefor, for measuring the resting state of accommodation, and for providing cognitive recognition of this accommodative state in order to facilitate bio-feedback training of that accommodative state. The need for precise lens accommodation to bring visual targets into sharp focus on the retina is far more urgent at night when contrast is very low, than in bright daylight. Unfortunately, it is at precisely this time that many individuals become myopic and further reduce the quality of an already poor visual image. GRA

N91-15685# Massachusetts Inst. of Tech., Cambridge. Artificial Intelligence Lab.

**DIRECT RECOVERY OF MOTION AND SHAPE IN THE GENERAL CASE BY FIXATION Memorandum Report**

M. ALI TAALEBINEZHAAD Mar. 1990 22 p (Contract N00014-85-K-0124) (AD-A225793; AI-M-1187) Avail: NTIS HC/MF A03 CSCL 06/4

## 53 BEHAVIORAL SCIENCES

In motion vision, the problem is to find, from a sequence of time varying images, the relative rotational and translational velocities between a viewer and an environment as well as the shape of objects in the environment. This paper introduces a direct method called fixation for solving the general motion vision problem. This method results in a constraint equation between translational and rotational velocities that in combination with the brightness-change constraint equation solves the general motion vision problem, arbitrary motion with respect to an arbitrary rigid environment. Avoiding correspondence and optical flow was the motive behind the direct methods because both solving the correspondence problem and computing the optical flow reliably have proven to be rather difficult and computationally expensive. Recent direct motion vision methods, which directly use the image brightness information such as temporal and spatial brightness gradients directly, have used the brightness-change constraint equation for solving the motion vision problem in special cases such as known depth, pure translation or known rotation, pure rotation, planar world and quadratic patches. In contrast to these solutions, the fixation method does not put such severe restrictions on the motion or the environment. GRA

**N91-15686#** Air Force Human Resources Lab., Brooks AFB, TX. Manpower and Personnel Div.  
**PREDICTIVE VALIDITY OF AN AUTOMATED PERSONALITY INVENTORY FOR AIR FORCE PILOT SELECTION** Interim Technical Paper, Jun. 1987 - Jun. 1990  
 FREDERICK M. SIEM Sep. 1990 18 p Submitted for publication  
 (Contract AF PROJ. 7719)  
 (AD-A226731; AFHRL-TP-90-55) Avail: NTIS HC/MF A03  
 CSCL 05/8

To examine the utility of personality testing for enhancing current Air Force pilot selection procedures, a sample of 509 USAF officers was given a computer-administered personality inventory, the Automated Aircrew Personality Profiler (AAPP) prior to entry into Undergraduate Pilot Training (UPT). Factor analysis of 16 scale scores indicated that the inventory comprised measures of five personality characteristics, of which three were directly associated with UPT training outcome (pass or fail): Self-confidence, Values Flexibility, and Hostility. UPT graduates scored higher on both positive dimensions and lower on hostility than did those individuals eliminated for flying training deficiency. The AAPP failed to add predictive utility to a selection model that combined test scores from the Air Force Officer Qualifying Test (AFOQT) and the Basic Attributes Tests (BAT) battery. GRA

**N91-15687#** Air Force Inst. of Tech., Wright-Patterson AFB, OH.  
**THE EFFECTS OF SITE CONFIGURATION ON A TACTILE INFORMATION DISPLAY FOR THE HUMAN HEAD** M.S. Thesis  
 MARIE E. LAMBERT 1990 98 p  
 (AD-A227704; AFIT/CI/CIA-90-067) Avail: NTIS HC/MF A05  
 CSCL 05/8

This research investigated the feasibility of using a tactile display to transmit information via the scalp. The purpose of the study was to compare performance for various stimulus site configurations. The first phase of the study investigated the number of sites that could be reliably detected and identified for the front section and the rear section of the scalp. Also during this phase, a multi-position array condition was investigated to determine target identification performance at twelve dispersed sites on the head. The second phase of the study determined whether target identification was possible under conditions of high mental workload. During this phase, the target identification task was conducted while performing the Criterion Task SET (CTS) Memory Search and Unstable Tracking dual-task to simulate the memory and motor output tasks encountered in a flying situation. Performance on the CTS dual-task declined significantly when performed with the target identification task. GRA

**N91-15688#** Air Force Inst. of Tech., Wright-Patterson AFB, OH.

**SHORT TERM RETENTION OF TEMPORAL SEQUENCE, SPATIAL LOCATION, AND ITEM MAGNITUDE INFORMATION** M.S. Thesis - Colorado Univ.

MICHAEL JAMES SCHEALL 1990 88 p  
 (AD-A227732; AFIT/CI/CIA-90-101) Avail: NTIS HC/MF A05  
 CSCL 05/7

Many models have been proposed to account for short term recall of temporally coded stimuli and associated decay and interference over short retention intervals, particularly concerning the role of phonetic coding in the retention of temporal information. Situations outside the laboratory setting generally involve both temporal and spatial information, but models pertaining to short term retention of spatial information, but models pertaining to short term retention of spatial information are less common. A third dimension concerning item information (verbal labels or visual characteristics such as shape or size which make objects discernable) has also been investigated in the laboratory setting, generally in a context which attempts to differentiate coding patterns between item and order information. GRA

**N91-16548#** Yale Univ., New Haven, CT. Dept. of Ophthalmology and Visual Science.

**LIMITS OF HUMAN VISUAL DISCRIMINATION: TOWARD A GENERAL MODEL OF VISUAL GEOMETRY** Final Technical Report, 1 Jan. 1986 - 31 Dec. 1989

JOY HIRSCH 1 Mar. 1990 10 p  
 (Contract AF-AFOSR-0077-86; AF PROJ. 2313)  
 (AD-A226826; AFOSR-90-0965TR) Avail: NTIS HC/MF A02  
 CSCL 06/4

The goal was to understand the neural computations that mediate the precision of human spatial vision. This goal was approached along three interrelated lines of research: (1) direct investigation of human and monkey retinal sampling mosaics; (2) psychophysical measurements of the precision of human spatial vision; and (3) computer simulations of human visual processes based on 'biologically correct' sampling lattices and 'behaviorally constrained' neural models of human spatial information processing. GRA

**N91-16549#** South Carolina Univ., Columbia. Dept. of Psychology.

**SKILL AND SKILLED MEMORY** Final Report, 1985 - 1988

JAMES J. STASZEWSKI 18 Feb. 1990 46 p  
 (Contract N00014-85-K-0524; NR PROJ. 667549)  
 (AD-A227697) Avail: NTIS HC/MF A03 CSCL 05/8

The findings are summarized of two longitudinal studies of expert-level cognitive skills and their acquisition. Their empirical, theoretical, and methodological contributions are described and some practical implications are discussed. Comprehensive analyses of subjects' learning and performance demonstrate that acquired knowledge, rather than exceptional native talents or general aptitudes, constitutes the foundation of expertise in the skills studied. They show that the knowledge structures and processing supporting expertise can be analyzed at a fine grain. Theoretically motivated analyses reveal that rapid and reliable storage and retrieval of information in Long Term Memory (LTM) appears to be a key general characteristic experts' information processing, and that acquired memory skills enable experts to use LTM efficiently to reduce the constraints that limited working memory capacity imposes upon performance in complex tasks. The studies also document the efficient information processing strategies on cognitive skill acquisition and expert performance. GRA

**N91-16550#** Johns Hopkins Univ., Baltimore, MD. Dept. of Psychology.

**PRE-ATTENTIVE AND ATTENTIVE VISUAL INFORMATION PROCESSING** Final Report, 1 Apr. 1987 - 30 Jun. 1990

HOWARD E. EGETH 5 Sep. 1990 12 p  
 (Contract AF-AFOSR-0180-87; AF PROJ. 2313)  
 (AD-A228541; AFOSR-90-1118TR) Avail: NTIS HC/MF A03  
 CSCL 05/8

Research project abstracts on several interrelated topics are presented. These projects are all in the area of visual cognition, and focus on feature and object perception, models of selective attention, and the nature of visual routines such as curve tracing and subitizing. The major thrust of this endeavor has been to explore the nature of visual processes to determine the extent to which they are carried out in parallel or in series. GRA

**N91-16551#** University of Southern California, Los Angeles. Signal and Image Processing Inst.

**RESEARCH IN OPTICAL SYMBOLIC TASKS Final Technical Report, 1 Jun. 1986 - 29 Nov. 1989**

KEITH JENKINS 29 Nov. 1989 151 p  
(Contract AF-AFOSR-0196-86; AF PROJ. 2305)  
(AD-A228797; AFOSR-90-1130TR) Avail: NTIS HC/MF A08  
CSCL 09/5

The research findings of the AFOSR Grant AFOSR-86-0196, Optical Symbolic Computing Tasks are summarized. The grant period was 1 June 1986 to 29 November 1989. Specifically, we have concentrated on the following topics: complexity studies for optical neural and digital systems, architecture and models for optical computing, learning algorithms for neural networks and applications of neural networks for early vision problems such as image restoration, texture segmentation, computation of optical flow and stereo. A number of conference and journal papers reporting the research findings have been published. A list of publications and presentation is given at the end of the report along with a set of reprints. GRA

**N91-16558#** Army Aeromedical Research Lab., Fort Rucker, AL.

**A COMPARISON OF COMPUTERIZED MEASUREMENT OF HELICOPTER PILOT PERFORMANCE WITH ATROPINE SULFATE DURING ACTUAL AND SIMULATED FLIGHT**

J. A. CALDWELL, JR. and H. D. JONES *In* AGARD, Safety Network to Detect Performance Degradation and Pilot Incapacitation 10 p Sep. 1990  
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The requirement for aviators to operate under stressful circumstances raises concerns over both safety and effectiveness. Although appropriate countermeasures for stress induced performance deteriorations are available, the implementation of these countermeasures require that commanders know the time course and extent of the problem. For this reason, the U.S. Army has focused research on the practical assessment of helicopter pilot degradation using flight performance assessments which combine enhanced automation and objectivity with optimized data analysis procedures. Recently, the sensitivity, accuracy, and consistency of these assessment systems were demonstrated while studying the effects of atropine sulfate on aviator performance. Both simulator and helicopter systems detected atropine related performance problems across a variety of aircraft control parameters. Also, analysis of combined simulator and helicopter data showed remarkable consistency of effects across the two flight platforms. This verification of performance measurement using computerized schemes in both simulator and aircraft has substantiated a feasible methodology, and has helped the concept development of better assessment devices. Author

**N91-16561#** Paris V Univ. (France). Lab. d'Anthropologie Appliquee.

**STUDY OF PILOT VIGILANCE DURING LONG RANGE FLIGHT [ETUDE DE LA VIGILANCE DES PILOTES AU COURS DE VOLS LONG-COURRIERS]**

A. COBLENTZ, R. MOLLARD, PH. CABON, J. P. FOUILLOT, and VINCENT CARMIGNANI (Direction Generale de l'Aviation Civile, Paris, France) *In* AGARD, Safety Network to Detect Performance Degradation and Pilot Incapacitation 17 p Sep. 1990 *In* FRENCH

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The various states of alertness and performance during the

course of monotonous activity has been demonstrated by many authors. In transport aviation, the monotony often found associated with the cycle of irregular work and timeshift is important. The interaction of these factors contribute to the amplification of a drop in performance and vigilance. After a study of pilot behavior during long range flight, a project was started. The objective was to identify phases of hypovigilance and to evaluate the repercussions on pilot performance. The method used rest deprivation as an objective evaluation of physiological levels of pilot alertness together with an analysis of different activities of electroencephalogram (EEG), electro-oculogram (EOG), and electrocardiogram (ECG) during flight. The cardiac frequency and driving wrist activity were both recorded during flight and periods of rest. The driving wrist activity allows the acquisition of data on the activity-rest cycles of pilots. The observation of activity and of crew task is made simultaneously in this recording using a coded grid. Eight long range transmeridian flights, north-south was used during the first stage of protocol completion. The first results show large variations in the EEG spectra and in the frequency of eye movements. The alternation of phases during which the pilots show elevated vigilance with drowsiness were seen in each crew member. The deprivation of sleep during stopover show repercussions on pilot behavior. In particular, the lowest vigilance appear most pronounced during flight following a night with sleep deprivation, especially if the flight is during the next day.

Transl. by E.R.

**N91-16562#** Johann-Wolfgang-Goethe-Univ., Frankfurt am Main (Germany, F.R.). Zentrum der Physiologie.

**COMPUTER AIDED PHYSIOLOGICAL ASSESSMENT OF THE FUNCTIONAL STATE OF PILOTS DURING SIMULATED FLIGHT**

KURT OFFENLOCH and GISELA ZAHNER *In* AGARD, Safety Network to Detect Performance Degradation and Pilot Incapacitation 9 p Sep. 1990 Sponsored by Dornier G.m.b.H. and Inspektion des Sanitaetswesens der Bundeswehr  
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Multichannel (polygraphic) analysis of cardiovascular and neurophysiological parameters provides very sensitive indicators of the functional state of subjects such as pilots during real or simulated flight missions which thus can be objectively assessed. In 6 pilots flying a fighter jet simulator with ALPHA JET dynamic characteristics without self motion, systolic and diastolic blood pressure, four channel electroencephalogram (EEG), electrooculogram (EOG), and electrocardiogram (ECG) were continuously recorded during a rest-activity-rest sequence for 60 min. The activities consisted of tracking another plane flying ahead of the piloted plane with four different degrees of difficulty. The analysis of the data, especially those of the EEG by Fast Fourier Transformation (FFT), revealed task dependent, and in the case of EEG, topographically different cortical activities depending upon whether sensory and/or motor systems were involved. The physiological measures thus obtained can serve as an objective criterion to assess the functional state of pilots and may serve as part of an automatic safety network not only in the event of sudden loss of consciousness but also in cases of lowered cases of pilot vigilance due to fatigue. Author

**N91-16564#** Dialogics S.A., Labège Innopole (France).

**INTELLIGENT ASSISTANT SYSTEMS: AN ARTIFICIAL INTELLIGENCE APPROACH TO DETECTING PERFORMANCE DEGRADATION AND PILOT INCAPACITATION**

GUY A. BOY *In* AGARD, Safety Network to Detect Performance Degradation and Pilot Incapacitation 6 p Sep. 1990  
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An artificial intelligence approach is presented to detecting performance degradation and pilot incapacitation. The motivations are discussed for Intelligent Assistant Systems in such situations. The problem of constructing procedures is shown to be a very critical issue. In particular, keeping procedural experience in both design and operation is critical. It is suggested what artificial

intelligence can offer in this direction, and the concept of Integrated Human-Machine Intelligence is presented. Some crucial problems induced by this approach are discussed in detail. Finally, the various roles are analyzed that would be shared by both the pilot and the intelligent assistant system. Author

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## MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

## A91-20543

### DETERMINING AIRCREW HELMET SIZE DESIGN REQUIREMENTS USING STATISTICAL ANALYSIS OF ANTHROPOMETRIC DATA

A. C. SIPPO and A. J. BELIAVIN (RAF, Institute of Aviation Medicine, Farnborough, England) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 62, Jan. 1991, p. 67-74. refs

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Traditionally, the number of aircrew helmet size rolls has been determined using head length and breadth for specified percentile ranges of a target population. Helmet mounted display technology will require taking the third dimension (pupil-vertex height) into account. Using data from 'An Anthropometric Survey of 2000 Royal Air Force Aircrew, 1970/1971', the three head dimensions of length, breadth, and pupil-vertex height were plotted for each subject. A minimum number of helmet sizes was calculated to achieve a reasonable quality of fit. The 93.5 percent of subjects grouped around the population mean was the largest fraction which had a reasonable quality of fit while using nine sizes. Attempts to fit a larger percentage would require either a large increase in the number of sizes or a relaxing of fitting quality. Author

## A91-20969

### BIOSPHERE II - ENGINEERING OF MANNED, CLOSED ECOLOGICAL SYSTEMS

WILLIAM F. DEMPSTER (Sarbid, Ltd.; Space Biospheres Ventures, Oracle, AZ) Journal of Aerospace Engineering (ISSN 0893-1321), vol. 4, Jan. 1991, p. 23-30. refs

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Biosphere II, a research project which integrates seven major biomic regions of the earth (i.e., a rainforest, a tropical savannah, marsh and ocean areas, a desert, an intensive agriculture area, and a habitat for the crew of eight biospherians) to imitate the earth's biosphere, is presented. The system is closed to exchanges of material or living organisms with the surrounding environment, and open to energy and information exchanges. The research tries to provide corrections for the disturbances that are caused by containment of the life systems, and is conducted in tissue-culture/analytical laboratories, greenhouses for horticulture/plant propagation, and a 480 cu m test module. The applications of the experimental results include scientific and ecological management research, refuges for endangered species, and life habitats for manned space stations. Biosphere II is scheduled for completion in March 1991. B.P.

## A91-22255#

### MATHEMATICAL MODEL OF HUMAN BODY FOR EJECTION SURVIVAL

FANGZI WANG, YUXIA XUAN, ZHI WANG, and XIANGCHANG ZHUANG (Space Medico-Engineering Institute, Beijing, People's Republic of China) Acta Astronautica et Astronautica Sinica (ISSN 1000-6893), vol. 11, Oct. 1990, p. B443-B448. In Chinese, with abstract in English. refs

A mathematical model of human body has been developed based on ejection tests. Combining vertebral breaking strength

with dynamic response characteristics of the model, human's tolerance limits of acceleration have been determined. The model is used to study the effects of ejection cushion, and a thin cushion is recommended for avoiding vertebral injury. Ways to improve the ejection propeller and to determine the requirements of acceleration measuring system are discussed. Author

## A91-22750

### BEYOND THE BODY'S LIMITS

BILL SWEETMAN Interavia Aerospace Review (ISSN 0020-6512), vol. 46, Jan. 1991, p. 56-58.

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Approaches to the problem of gravity-induced loss of consciousness (GLOC) connected with the increasing demand for fighter aircraft agility are considered. The USAF's leading anti-GLOC program is 'Combat Edge', an assisted positive-pressure breathing system. When the system detects increasing gravity forces it pressures air into the pilot's lungs through a modified mask that automatically tightens the mask straps. The F-16's, which have experienced most of the GLOC losses in the USAF, are to be fully equipped in 1992, as will the F-15 fighters. An added improvement to this system is the flight-control activated anti-g valve that is designed to interface with the MIL-STD-1553B databus, so that it responds when the pilot commands high g through the flight control system, rather than reacting to the movement of the aircraft. Development is continuing on a loss-of-consciousness monitoring system, which would trigger an automatic recovery system and prevent the aircraft from crashing. R.E.P.

## A91-23009

### JAPAN ROBOTICS AIM FOR UNMANNED SPACE EXPLORATION

WILLIAM L. WHITTAKER and TAKEO KANADE (Carnegie-Mellon University, Pittsburgh, PA) IEEE Spectrum (ISSN 0018-9235), vol. 27, Dec. 1990, p. 64-67.

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The findings of a study sponsored by the NSF and NASA's Automation and Robotics Program, prepared for the U.S. government's program evaluating Japanese technology, are summarized. They reveal that the Japanese government, industry, and university leaders have embarked on cooperative projects to develop next-generation robots for space. The goals are to minimize the enormous expense of manned space operations and to spur technology by developing a range of automated machines. Japanese robots are now employed in construction projects on land and under water, providing experience that may be applicable in space. An overview is given of notable developments to date. I.E.

A91-23451 National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.

### THE PHYSIOLOGY OF SPACECRAFT AND SPACE SUIT ATMOSPHERE SELECTION

J. M. WALIGORA, D. J. HERRIGAN (NASA, Johnson Space Center, Houston, TX), and A. NICOGLOSSIAN (NASA, Life Sciences Div., Washington, DC) (IAA, IAF, AN SSSR, et al., Symposium on Man in Space, 8th, Tashkent, Uzbek SSR, Sept. 29-Oct. 3, 1990) Acta Astronautica (ISSN 0094-5765), vol. 23, 1991, p. 171-177. refs

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Factors which are considered in arriving at control values and control ranges of the parameters established for spacecraft and space suit environments include physiological, engineering, operational cost, and safety considerations. A number of physiological considerations are discussed, including hypoxia and hyperoxia, hypercapnia, temperature regulation, and decompression sickness. The impact of these considerations on space craft and space suit atmosphere selection is considered. The past experience in controlling these parameters in the U.S. and Soviet spacecraft and space suits and the associated physical responses are also reviewed. Physiological factors currently under investigation are discussed, including decompression sickness. L.K.S.

**A91-23452****OUR EXPERIENCE IN THE EVALUATION OF THE THERMAL COMFORT DURING THE SPACE FLIGHT AND IN THE SIMULATED SPACE ENVIRONMENT**

LUDVIK NOVAK (Universita J. E. Purkyne, Brno, Czechoslovakia) (IAA, IAF, AN SSSR, et al., Symposium on Man in Space, 8th, Tashkent, Uzbek SSR, Sept. 29-Oct. 3, 1990) Acta Astronautica (ISSN 0094-5765), vol. 23, 1991, p. 179-186. refs

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A mathematical model is used to examine the effects of hypogravity on the heat output by spontaneous convection. The structure of heat output in an adult male in thermoneutral conditions is outlined. Calculations are made of dry heat output, noting that it is possible to express the three forms of dry heat output by means of linear equations. The use of an electric dynamic katathermometer and the effect of microgravity on the heat output are discussed, and the effects of microgravity on skin temperature and thermal comfort are examined. L.K.S.

**A91-23453****EVA MEDICAL PROBLEMS**

A. S. BARER (Institut Mediko-Biologicheskikh Problem, Moscow, USSR) (IAA, IAF, AN SSSR, et al., Symposium on Man in Space, 8th, Tashkent, Uzbek SSR, Sept. 29-Oct. 3, 1990) Acta Astronautica (ISSN 0094-5765), vol. 23, 1991, p. 187-193. refs

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The experience gained in the USSR allows the following conclusions to be made: physiological responses to EVA do not depend on flight duration in qualitative and quantitative terms. Physiological responses to EVA are mainly determined by the following factors: (1) physiological activities; (2) space suit environmental parameters; and (3) physiological stress. This paper reviews problems associated with altitude decompression sickness as well as thermal regulation of the body, visual function and physiological psychological stress, and individual EVA experience in physiological responses. Author

**A91-23454****EUROPEAN EVA DECOMPRESSION SICKNESS RISKS**

LORENZ VOGT, JUERGEN WENZEL (DLR, Institut fuer Flugmedizin, Cologne, Federal Republic of Germany), A. I. SKOOG, S. LUCK (Dornier GmbH, Friedrichshafen, Federal Republic of Germany), and BENGT SVENSSON (ESTEC, Mechanical System Dept., Noordwijk, Netherlands) (IAA, IAF, AN SSSR, et al., Symposium on Man in Space, 8th, Tashkent, Uzbek SSR, Sept. 29-Oct. 3, 1990) Acta Astronautica (ISSN 0094-5765), vol. 23, 1991, p. 195-205. refs

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The results of an ESA study on decompression sickness risks for European EVA are presented and discussed. The investigation included crew selection and criteria for EVA astronauts, medical monitoring procedures during EVA, and therapeutic measures. The pressure reduction from the Hermes cabin pressure of 1013 hPa will pose a risk of decompression sickness (DCS) for the EVA crewmember. On the basis of a critical review of literature in the fields of diving and aerospace medicine, recommendations are given for specific decompression procedures for such EVA situations. An R factor of 1.2 and a tissue half-time of 360 minutes in a single-tissue model have been identified as appropriate operational values. Oxygen prebreathing times are proposed for both direct pressure reduction from 1013 hPa to a suit pressure of 500 hPa and for staged decompression using a 700 hPa intermediate stage in the spacecraft cabin. Factors which influence individual susceptibility to DCS are also identified. L.K.S.

**A91-23455****THE EUROPEAN SPACE SUIT - A DESIGN FOR PRODUCTIVITY AND CREW SAFETY**

A. INGEMAR SKOOG (Dornier GmbH, Friedrichshafen, Federal Republic of Germany) and BERTHIER S. OLLIVIER (Dassault Aviation, Saint-Cloud, France) (IAA, IAF, AN SSSR, et al., Symposium on Man in Space, 8th, Tashkent, Uzbek SSR, Sept.

29-Oct. 3, 1990) Acta Astronautica (ISSN 0094-5765), vol. 23, 1991, p. 207-216.

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The crew safety and productivity criteria that are essential to the design and construction of the European Space Suit System (ESSS) are discussed. A summary of major ESSS requirements is presented, including specifications for sortie duration (7 h), number of EVA crew (2), useful life (15 yrs), and emergency life support (30 min minimum). It is noted that the design of the ESSS is due to the Hermes/Columbus specific mission objectives and incorporates optimal solutions for individual features from both the U.S. and USSR space suit concepts. Also provided are almost 'hands-free' operations, zero prebreath, unassisted donning/doffing, and a high operational flexibility due to a multifunction LCD and voice processing. L.K.S.

**A91-23458****RADIATION PROTECTION STRATEGIES IN HERMES MISSIONS**

J. C. BOURDEAUD'HUI, N. FEUILLAIS, and J.-M. CONTANT (Aerospatiale, Les Mureaux, France) (IAA, IAF, AN SSSR, et al., Symposium on Man in Space, 8th, Tashkent, Uzbek SSR, Sept. 29-Oct. 3, 1990) Acta Astronautica (ISSN 0094-5765), vol. 23, 1991, p. 233-244.

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The radiation environment in circumterrestrial space is discussed, and doses received over several Hermes missions are predicted. Various strategies for avoiding dangerous dose levels are examined. For low inclination orbits and orbits of 28.5-deg inclination (which will be used most frequently by Hermes), the danger from radiation is found to be low. The dose level during EVA can be reduced by correct planning of the time out. During an anomalously large solar event, special precautions may need to be taken, depending on the orbit used, and in polar missions an emergency return should be planned for. A.F.S.

**A91-23459****GERMAN CELSS RESEARCH WITH EMPHASIS ON THE C.E.B.A.S.-PROJECT**

VOLKER BLUEM (Bochum, Ruhr-Universitaet, Federal Republic of Germany) and KARLHEINZ KREUZBERG (DLR, Cologne, Federal Republic of Germany) (IAA, IAF, AN SSSR, et al., Symposium on Man in Space, 8th, Tashkent, Uzbek SSR, Sept. 29-Oct. 3, 1990) Acta Astronautica (ISSN 0094-5765), vol. 23, 1991, p. 245-252. refs

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The various components and goals of the German CELSS research program is described. The program covers both animal and plant systems under microgravity. The current activities of the German Federal Ministry of Research and Technology (BMFT) and of the German Aerospace Establishment (DLR) in the field of closed and controlled biological life support system research is presented. A short overview is then given of the most advanced project in this field, the Aquarack project. S.A.V.

**A91-23460****LUNAR BASE EXTENSION PROGRAM AND CLOSED LOOP LIFE SUPPORT SYSTEMS**

KEIJI NITTA (National Aerospace Laboratory, Chofu, Japan) and HARUHIKO OHYA (Yokohama National University, Japan) (IAA, IAF, AN SSSR, et al., Symposium on Man in Space, 8th, Tashkent, Uzbek SSR, Sept. 29-Oct. 3, 1990) Acta Astronautica (ISSN 0094-5765), vol. 23, 1991, p. 253-262. refs

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The ECLSS technologies to be used in the initial habitat outpost and the design philosophy of the closed-loop technologies to be utilized in the final stage of a lunar-base extension program are described. The requirements of the human metabolism are reviewed, and the necessary environment needed to support these functions is outlined. L.K.S.



A91-23461

**BIOGENERATIVE LIFE-SUPPORT SYSTEM - FARMING ON THE MOON**

FRANK B. SALISBURY (Utah State University, Logan) (IAA, IAF, AN SSSR, et al., Symposium on Man in Space, 8th, Tashkent, Uzbek SSR, Sept. 29-Oct. 3, 1990) Acta Astronautica (ISSN 0094-5765), vol. 23, 1991, p. 263-270. refs

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Plants can be used to recycle food, oxygen, and water in a closed habitat on the moon, on Mars, or in a spacecraft. A variety of crops might be grown, probably in underground growth units to avoid harmful radiation and micrometeorites. Artificial light will be necessary, although some sunlight might be brought in via fiber optics. Transpired water will be condensed in coils exposed to space and shaded from sunlight. Oxygen and CO<sub>2</sub> levels will be maintained by controlling photosynthesis and waste oxidation. Plants will be grown hydroponically. Wheat has been produced at the rate of 60 g/sq m per day, which could feed a human continuously from a farm only of 13 sq m, but nearly continuous light equivalent to sunlight is required along with ideal temperatures, enriched CO<sub>2</sub>, suitable cultivars, etc. Author

A91-23462

**REGENERATIVE LIFE-SUPPORT SYSTEM DEVELOPMENT PROBLEMS FOR THE MARS MISSION**

V. N. KUBASOV, E. N. ZAITSEV, V. A. KORSKOV, A. S. GUZENBERG, and A. A. LEPSKII (NPO Energiia, Moscow, USSR) (IAA, IAF, AN SSSR, et al., Symposium on Man in Space, 8th, Tashkent, Uzbek SSR, Sept. 29-Oct. 3, 1990) Acta Astronautica (ISSN 0094-5765), vol. 23, 1991, p. 271-274.

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The advantages and disadvantages of physiochemical and biotechnological complexes of life support systems are discussed. These systems are each analyzed on the basis of technological, economic, and biomedical parameters. The complex of technological and economic parameters includes the mass, power consumption, reliability, maintainability, and crew labor outlay both in the initial condition and under operating conditions. The most likely trends of manned cosmonautics development for the nearest decades are discussed. Analysis results show that the physiochemical complex is more advantageous than the biotechnological one for all cases considered. This conclusion is based on significant differences in energy utilization factors: 70-90 percent for the PhChLSS and 5-10 percent for the BLSS. System selection is also discussed. L.K.S.

A91-23463

**PROVIDING A SOUND HABITAT FOR MAN IN SPACE**

MARIA STRANGER-JOHANNESSEN (Centre for Industrial Research, Oslo, Norway) (IAA, IAF, AN SSSR, et al., Symposium on Man in Space, 8th, Tashkent, Uzbek SSR, Sept. 29-Oct. 3, 1990) Acta Astronautica (ISSN 0094-5765), vol. 23, 1991, p. 275-277. refs

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The problem of microbial growth on materials in a closed environment is discussed, drawing inferences from analogous situations which occur in new buildings which are more tightly sealed and widely employ air conditioning. It is noted that the 'sick building syndrome' has contributed to serious problems such as legionnaire's disease and that the potential of such microbiological hazards must be researched and guarded against in long-term space habitats. ESA has begun work on microbial contamination control measures and requirements. Procedures are being established as a basis for the microbiological cleanliness of the manned space environment and for the avoidance of microbiological growth on materials and equipment. Several testing techniques are being studied which will allow both a rapid screening of materials' resistance to microbiological growth and proper durability testing of materials and equipment to be used for up to 30 years in space habitats. L.K.S.

A91-23464

**MANNED EXPEDITION TO MARS - CONCEPTS AND PROBLEMS**

LIUBOV' B. STROGONOVA (Institut Mediko-Biologicheskikh Problem, Moscow, USSR) and LEONID GORSHKOV (NPO Energiia, Moscow, USSR) (IAA, IAF, AN SSSR, et al., Symposium on Man in Space, 8th, Tashkent, Uzbek SSR, Sept. 29-Oct. 3, 1990) Acta Astronautica (ISSN 0094-5765), vol. 23, 1991, p. 279-287.

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The concept of long-term interplanetary flight is discussed, and some main criteria for interplanetary spacecraft are presented. The present state of space technology for interplanetary spacecraft is considered, and it is argued that the knowledge accumulated at present by cosmonauts is sufficient to begin preparation for a manned flight to Mars. An eight-stage program for such a flight, which is projected to have a duration of two years, is presented. The biomedical aspects of long-term interplanetary flight and the complications arising due to lack of technical supply for the solution of such problems are considered. The questions of the biological security of the earth after the planetary flight and of international cooperation in interplanetary expeditions are also addressed. L.K.S.

A91-23465\* National Aeronautics and Space Administration, Washington, DC.

**NEUROSCIENCES RESEARCH IN SPACE - FUTURE DIRECTIONS**

FRANK M. SULZMAN and JAMES W. WOLFE (NASA, Washington, DC) (IAA, IAF, AN SSSR, et al., Symposium on Man in Space, 8th, Tashkent, Uzbek SSR, Sept. 29-Oct. 3, 1990) Acta Astronautica (ISSN 0094-5765), vol. 23, 1991, p. 289-293. refs

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In order to gain a better understanding of the effects of long-duration space missions on the central nervous system, near-term research, to take place from 1990-1995, will be directed at investigating the acute effects of microgravity and the 'space adaptation syndrome'. These include experiments scheduled for the Spacelab Life Sciences 1 which is designed to evaluate changes in the visual, vestibular, and proprioceptive systems. An extensive series of experiments, collectively termed Microgravity Vestibular Investigations (MVI), is also planned for the IML-1 mission to be flown in 1992. The IML-2 mission will emphasize behavior and performance, biological rhythms, and further vestibular studies. Mid-term goals, projected to be achieved from 1995-2000, include the use of new technology such as magnetic recording techniques. Long-term goals are also discussed including studies dealing with neuronal plasticity and sensory substitution, augmentation, and robotic telepresence. L.K.S.

A91-23470

**NEW NON-INVASIVE TECHNIQUES FOR CREW HEALTH MONITORING IN SPACE**

D. GRUNDY and P. A. HANSSON (Sheffield, University, England) (IAA, IAF, AN SSSR, et al., Symposium on Man in Space, 8th, Tashkent, Uzbek SSR, Sept. 29-Oct. 3, 1990) Acta Astronautica (ISSN 0094-5765), vol. 23, 1991, p. 321-325. refs

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The present paper discusses some of the available non-invasive methods that are currently being evaluated at the University of Sheffield. Applied potential tomography (APT) has considerable potential as an imaging system (albeit of low resolution), which can be readily transferable to the space environment and provide information on fluid shifts on insertion into, and subsequently adaptation to, microgravity. Modern biochemical methods for the analysis of urine can provide information on many aspects of metabolic activity. The monitoring of bone formation and resorption is particularly relevant to space. The bodies handling of food can additionally be investigated by monitoring non-invasively the transit of contents through the gastrointestinal tract. These and other non-invasive monitoring techniques offers to move space medicine closer to clinical observation systems used on earth. Author

**N91-15689#** Naval Aerospace Medical Research Lab., Pensacola, FL.

**SUSTAINED/CONTINUOUS OPERATIONS SUBGROUP OF THE DEPARTMENT OF DEFENSE HUMAN FACTORS ENGINEERING TECHNICAL GROUP: PROGRAM SUMMARY AND ABSTRACTS**

D. F. NERI, comp. and R. E. GADOLIN, comp. Mar. 1990 55 p Presented at the 9th Semiannual Meeting, Pensacola, FL, 11-12 July 1989

(AD-A223901; NAMRL-SR-90-1) Avail: NTIS HC/MF A04

CSCL 23/2

The meeting took form of a symposium. Twelve speakers provided overviews of SUSOPS/CONOPS issues and described current research efforts. A synopsis and abstracts are presented of the presentations, consistent with the goals of the subgroup to provide a mechanism for information exchange, enhance coordination among government agencies, identify technology gaps and requirements, and encourage technical interaction. GRA

**N91-15690** Tel-Aviv Univ. (Israel). Dept. of Interdisciplinary Studies.

**A METHOD TO MEASURE DYNAMIC CONTACT STRESSES BETWEEN FLEXIBLE BODIES WITH APPLICATION TO BIOMECHANICS M.S. Thesis**

DAVID PRUTCHI Dec. 1988 189 p

(ITN-91-85068) Copyright Avail: Tel-Aviv Univ., Exact Sciences Library, Ramat Aviv 69978, Israel

The aim is to develop a method, instrument, and techniques to measure and analyze the dynamic contact stress distribution between the human body and a supporting flexible cushion. Conductive silicon elastomers formed the sensing material in transducer elements developed and evaluated as local contact stress measurement transducers. The three different sensors whose static and time dependent properties were measured were: Graphite loaded conductive foam; the commercially manufactured Force Sensing Resistor, based on variations of mechanical contact between a conductive elastomer and a metallic electrode; and the Contact Geometric Modulation Transducer (CGMT), based on the pressure induced change in contact area between a V-shaped conductive elastomer string and comb-like contact electrodes. The last type was developed to overcome some limitations of the other two. The sensors were used in the form of a matrix array, in flexible printed circuit boards, designed to form thin, flexible, high resolution pressure sensing mats which can comply with the interface between a human body and a supporting cushion. A new technique was developed to analyze the data yielded by the measurement of the contact pressures. This technique is based on the time domain to frequency domain transformation of the data collected at every location, and was implemented through the use of the Fast Fourier Transform algorithm; it presents the results in the form of spectral components of the contact stresses. This data analysis method provides the basis of a technique for designing and evaluating composite cushioning systems, intended to protect the human body from vibration and impact loads. Further biomechanical applications are proposed, e.g., the study and prevention of decubitus ulcer formation; and the design of work chairs. ISA

**N91-15940\*#** National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.

**DISCOURSE FOR SLIDE PRESENTATION: AN OVERVIEW OF CHEMICAL DETECTION SYSTEMS**

RANDY ALAN PETERS, THEODORE J. GALEN (Krug International, Houston, TX.), and DUANE L. PIERSON /In NASA, Marshall Space Flight Center, Space Station Freedom Toxic and Reactive Materials and Handling 7 p Jul. 1990

Avail: NTIS HC/MF A99 CSCL 06/11

A brief overview of some of the analytical techniques currently used in monitoring and analyzing permanent gases and selected volatile organic compound in air are presented. Some of the analytical considerations in developing a specific method are discussed. Four broad groups of hardware are discussed: compound class specific personal monitors, gas chromatographic

systems, infrared spectroscopic systems, and mass spectrometric residual gas analyzer systems. Three types of detectors are also discussed: catalytic sensor based systems, photoionization detectors, and wet or dry chemical reagent systems. Under gas chromatograph based systems five detector systems used in combination with a GC are covered: thermal conductivity detectors, photoionization detectors, Fourier transform infrared spectrophotometric systems, quadrupole mass spectrometric systems, and a relatively recent development, a surface acoustic wave vapor detector. Author

**N91-15943\*#** Oak Ridge National Lab., TN.

**IMPORTANCE OF BIOLOGICAL SYSTEMS IN INDUSTRIAL WASTE TREATMENT POTENTIAL APPLICATION TO THE SPACE STATION**

NATHANIEL REVIS and GEORGE HOLDSWORTH /In NASA, Marshall Space Flight Center, Space Station Freedom Toxic and Reactive Materials Handling 19 p Jul. 1990

Avail: NTIS HC/MF A99 CSCL 06/11

In addition to having applications for waste management issues on planet Earth, microbial systems have application in reducing waste volumes aboard spacecraft. A candidate for such an application is the space station. Many of the planned experiments generate aqueous waste. To recycle air and water the contaminants from previous experiments must be removed before the air and water can be used for other experiments. This can be achieved using microorganisms in a bioreactor. Potential bioreactors (inorganics, organics, and etchants) are discussed. Current technologies that may be applied to waste treatment are described. Examples of how biological systems may be used in treating waste on the space station. B.G.

**N91-16552#** Air Force Human Resources Lab., Brooks AFB, TX.

**HUMAN FACTORS DESIGN GUIDANCE DURING THE CONCEPTUAL DESIGN PHASE OF SYSTEM DEVELOPMENT: A METHODOLOGICAL APPROACH Final Technical Report, Aug. 1985 - Sep. 1989**

LAWRENCE S. FINEGOLD and MICHAEL T. LAWLESS Jun. 1990 14 p

(Contract AF PROJ. 3017)

(AD-A224667; AFHRL-TR-89-66) Avail: NTIS HC/MF A03

CSCL 23/2

Current design process limitations inhibit the most effective use of human factors data in the design of complex man-machine systems. These limitations are described and a possible methodological solution is offered that incorporates human factors issues into the conceptual phase of system design. A current Air Force weapon system is reviewed historically and an application of the methodology to this system is reported. The methodological approach uses subject matter experts to assess various human performance issues on hypothetical systems through mental imagery. In-depth research was required to fully describe the hypothetical systems so that conceptualized operations could be conducted. Lessons learned are presented. GRA

**N91-16553#** Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France). Aerospace Medical Panel.

**SAFETY NETWORK TO DETECT PERFORMANCE DEGRADATION AND PILOT INCAPACITATION**

Sep. 1990 120 p In ENGLISH and FRENCH Symposium held in Tours, France, 2 Apr. 1990

(AGARD-CP-490; ISBN-92-835-0580-8) Copyright Avail: NTIS HC/MF A06; Non-NATO Nationals requests available only from AGARD/Scientific Publications Executive

The proceedings from this conference are presented. Recent advances in technology are making feasible the concept of a Safety Net system temporarily overriding the authority of the partially or fully incapacitated pilot until he/she is able to resume full control of the aircraft. The current status of technological developments as well as philosophical issue which must be addressed are reviewed.



**N91-16556#** Aerospace Medical Research Labs., Wright-Patterson AFB, OH. Acceleration Effects Branch.

**CURRENT STATUS OF AN ARTIFICIAL INTELLIGENCE-BASED LOSS OF CONSCIOUSNESS MONITORING SYSTEM FOR ADVANCED FIGHTER AIRCRAFT**  
WILLIAM B. ALBERY and ROBERT E. VANPATTEN (Van Patten, Robert E., Bellbrook, OH) /In AGARD, Safety Network to Detect Performance Degradation and Pilot Incapacitation 8 p Sep. 1990

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During the past decade, fourteen U.S. Air Force pilots lost their lives and aircraft to gravity induced loss of consciousness (GLOC). GLOC is not a new problem, it has been around for over 70 years. Because of the emergence of high performance aircraft such as the F-16 and F-15 and the fact that these aircraft can perform beyond the acceleration tolerance limits of the human, GLOC has become the U.S. Tactical Air Force's second most serious human factors problem, second only to spatial disorientation. To date, there exists no monitoring system in USAF aircraft to detect when a pilot has become incapacitated due to GLOC. The incorporation of high G onset training and a special centrifuge training facility will help reduce, but not eliminate, the GLOC problem. The current status is presented of a LOC detection and recovery system being developed. Author

**N91-16557#** Defense Advanced Research Projects Agency, Arlington, VA. Tactical Technology Office.

## **FRAMEWORK FOR AN EFFICIENT TWO FILTER GLOC MONITOR**

DENNIS K. MCBRIDE and ELIZABETH A. DAVIES (Naval Air Test Center, Patuxent River, MD.) /In AGARD, Safety Network to Detect Performance Degradation and Pilot Incapacitation 7 p Sep. 1990

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A multiple filter Gravitational Loss of Consciousness (GLOC) design framework was derived. The framework recognizes the computational limitations of current and modified airborne avionics suites. The sequential gating approach minimizes load on supporting computer resources. As context and symptoms dictate, however, appropriate processing is applied. The framework is introduced as a provocative statement of design constraints inherent in 1970's jet architectures. The simplicity of design and implementation minimizes software engineering requirements, and holds hardware/interface development to but one requisite innovation; a helmet integrated, ICS capable earplug that would serve as a blood velocity, Doppler sensing and transducing agent. Author

**N91-16559#** British Aerospace Public Ltd. Co., Bristol (England).

## **EEG INDICATORS OF MENTAL WORKLOAD: CONCEPTUAL AND PRACTICAL ISSUES IN THE DEVELOPMENT OF A MEASUREMENT TOOL**

M. R. HICKS /In AGARD, Safety Network to Detect Performance Degradation and Pilot Incapacitation 7 p Sep. 1990

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A first objective in the development of a pilot state monitor is the development of a lab tool capable of measuring mental workload. Several general performance benchmarks are identified that facilitate the evaluation of such techniques and a recent program of research is described and assessed in the light of these criteria. Author

**N91-16560#** Royal Aerospace Establishment, Farnborough (England).

## **OPTIMISATION OF OPERATIONAL WORKLOAD LEVELS USING NEUROPHYSIOLOGICAL AND COGNITIVE TECHNIQUES**

D. W. BURGESS, J. A. CHILLERY, S. JENSEN, and A. HALL /In AGARD, Safety Network to Detect Performance Degradation and

Pilot Incapacitation 7 p Sep. 1990

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Extremes of operational workloads were identified and assessed using either existing measures, e.g., NASA TLX, SWAT, etc., together with neurological measurements. Data already exists from specialist labs which show a reliable increase in the DC levels of brain activity with increasing workloads. In order to optimize workloads, the objective of future missions are predicted and analyzed. Following this detailed task analysis, timeline analysis and attentional demand analysis are used to identify the extent to which particular cognitive channels, e.g., visual, auditory, and psychomotor are being used at any one time. In parallel with this analysis, evoked response techniques are developed from the lab studies towards man mountable apparatus for in-flight use. This requires the development of low noise electrically isolated DC amplifiers of high dynamic range design to obtain physiological data from the man with the minimum of operator support. An aim is to provide a high degree of perceived realism in lab tasks including the accomplishment of secondary tasks. Author

**N91-16563#** Man-Made Systems Corp., Ellicott City, MD.

## **DEVELOPMENT OF A TEST-BED FOR REAL-TIME MONITORING OF PILOT MENTAL STATUS**

RICHARD L. HORST, DAN T. SMITH, and JOHN K. NEBEL (Advanced Resource Development Corp., Columbia, MD.) /In AGARD, Safety Network to Detect Performance Degradation and Pilot Incapacitation 9 p Sep. 1990

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The real time determination of pilot mental and physical status is a critical feature of the workload monitoring and Mindware subsystems that have been envisioned for future jet aircraft. Recent lab and simulator studies, using retrospective data analyses, have suggested the value of various behavioral and physiological indices for reflecting task performance. Software algorithms were developed to derive some of these measures in real time and to develop a test bed in which to explore the efficacy of these measures for inferring operationally relevant changes in pilot status. The project showed the feasibility and usefulness of the approach. Data processing algorithms were developed for characterizing and integrating physiological indices based on heart rate and heart rate variability, eye blinks, and single trial, scalp recorded event related potentials. These physiological measures were obtained concurrently with behavioral measures as subjects performed a PC based, aviation simulation task. The data processing algorithms were implemented in a distributed processing configuration, using multiple personal computers, with the derived measures being integrated by a decision maker multiprocessor. Author

**N91-16565#** Ballistic Research Labs., Aberdeen Proving Ground, MD.

## **REMOVAL OF NO AND NO2 FROM CONTAMINATED ATMOSPHERES Final Report, 22 Jun. - 18 Aug. 1989**

ANTHONY E. FINNERTY, GOULD GIBBONS, JR., MATTHEW SCHROEDER, LISA COPLAND, and TANYA SWIDERSKI Sep. 1990 37 p

(AD-A227260; BRL-MR-3860) Avail: NTIS HC/MF A03 CSCI 07/2

Laboratory studies were carried out to determine the feasibility of removing certain toxic gases from a vehicle atmosphere. Both nitrogen dioxide (NO2) and nitric oxide (NO) were studied in the concentration range 200 to 2000 parts per million (ppm). Only non-toxic agents were considered for removal of these gases. The most efficient scrubbing agents found were: water, diammonium phosphate and Monnex with NO2, MAP (mono-ammonium phosphate) and alum with NO. Unfortunately, no single powder showed promise of removing both the toxic gases. The presence of a base (sodium bicarbonate) in the water mist did not enhance the removal of NO2 from the atmosphere. GRA

**N91-16566\*#** National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.

**WHOLE BODY CLEANSING AGENT Patent Application**  
STEVEN E. LENTSCH, inventor (to NASA) (ECO-Labs., Cleveland, OH.) 29 May 1990 15 p  
(NASA-CASE-MSC-21589-1; NAS 1.71:MSC-21589-1;  
US-PATENT-APPL-SN-529427) Avail: NTIS HC/MF A03 CSCL 06/11

The subject invention relates to a human cleansing agent particularly suitable for use in long duration spaceflight and a method of bathing with the agent. The agent of the subject invention is in the form of a paste having a pH of 5.0 to 7.9 which comprises an acyltaurate, a skin conditioner, a hair conditioner, and a preservative. More specifically, it includes sodium N-coconut acid-N-methyl taurate, in combination with soybean lecithin, polyquaternium 16, and formalin. This particular combination satisfies the following objectives: (1) that it be usable with a minimum amount of water per shower (approximately 1 gallon); (2) that it be easily separated from the water for purposes of water reclamation; (3) that it be pH compatible with skin and hair; (4) that it rinse well in deionized water; (5) that it be mild to skin and eyes; (6) that it effectively clean both skin and hair; (7) that it be suitable for use in zero gravity; and (8) that it provide ease of combing of wet and dry hair. The method of the invention includes the steps of wetting the skin and hair with a small quantity of water, lathering the skin with the paste, rinsing the lather from the skin and hair with a small quantity of water to produce a rinse water containing the cleansing agent, defoaming the rinse water, and supplying the defoamed rinse water to a water reclamation unit for recycling the water. The novelty of the invention appears to lie in the particular formulation of the cleansing agent and its method of use which provide optimal results under the given constraints and objectives. NASA

**N91-16567#** National Academy of Sciences - National Research Council, Washington, DC. Committee on Human Factors.

**APPLICATION PRINCIPLES FOR MULTICOLORED DISPLAYS: A WORKSHOP REPORT**

JOANN S. KINNEY, ed. and BEVERLY MESSICK HUEY, ed.  
National Academy Press 1990 73 p Workshop held in Washington, DC, 22 Oct. 1990  
(Contract N00014-85-G-0093; MDA903-88-C-0031;  
MDA903-89-K-0074)  
(AD-A227961) Avail: NTIS HC/MF A04 CSCL 12/6

The Committee on Human Factors organized the Workshop on Application Principles for Multicolored Displays to examine a subset of problems associated with the current use of color in displays. Multicolored displays are used in a variety of civilian and military systems, and the rapid expansion of the field has technical developments from diverse fields. A great number of complex, interacting factors determine the effectiveness of a color display system. Although many of these factors characterize visual displays in general, many others are specifically related to the production and use of color. The latter include both human visual perceptual factors and color display hardware characteristics that cannot reasonably be treated in isolation. There is substantial evidence that people prefer color. The significantly higher sales of color television sets and color photographic film and the almost exclusive production of motion pictures in color are examples of the preference. Since color will probably be used, even demanded, in displays, whether essential or not, a high priority should be given to employing it effectively, even though multicolored displays are not necessary or advantageous for all applications. GRA

**N91-16568** Institute for Perception RVO-TNO, Soesterberg (Netherlands).

**ORGANIZATION OF THE MISSION PATTERN IN THE AIR PICTURE Final Report**

P. J. M. D. ESSENS 28 Feb. 1990 22 p In DUTCH; ENGLISH summary  
(Contract A87/KLU/131)  
(IZF-1990-A-12; TD-90-0026; ETN-91-98311) Copyright Avail:

Institute for Perception RVO-TNO, P.O. Box 23, 3769 ZG Soesterberg, Netherlands

In an experiment with fighter allocators the organization of the mission pattern in a dynamic air picture was investigated with two types of presentation. A comparison, in terms of search times and mental image of the mission pattern, was made between an air picture in which the own and enemy aircraft coupled in the mission have the same color, and one in which those elements of a mission pattern shows that the mental image with color coding is richer than with line coding. The number of recalled missions is about 10 percent higher. There is no difference in the spatial accuracy for the two types of presentation. The search time (about 3 sec) is the same in the two conditions. The subjects strongly preferred color coding. The comments of the subjects indicate that the air picture is more organized. ESA

**N91-16569** Institute for Perception RVO-TNO, Soesterberg (Netherlands).

**HEAT TRANSFER IN CLOTHING DURING HEAT RADIATION Final Report**

A. M. J. PIETERS and W. A. LOTENS 22 Jan. 1990 61 p In DUTCH; ENGLISH summary  
(IZF-1990-B-2; TD-89-4561; ETN-91-98390) Copyright Avail:  
Institute for Perception RVO-TNO, P.O. 23, 3768 ZG Soesterberg, Netherlands

A model to calculate temperatures and heat flows with one-sided heat radiation is suggested. Two clothing layers were taken into account in the model. The model is based on a network and calculates the temperatures in both layers, the microclimate, and the heat flow from skin and clothing. For the experimental verification only the dry heat flow was measured by wrapping the subjects in plastic foil. Wind and movement decrease clothing temperature and insulation. Measured and calculated temperatures agree very well. In an experiment where the subjects wore absorbing, reflecting, and transmitting garments while walking, the radiation properties were determined; the mean difference between measured and calculated temperatures and heat flows was 1.2 C and 2.2 W, respectively. ESA

**N91-16570#** Messerschmitt-Boelkow-Blohm G.m.b.H., Bremen (Germany, F.R.).

**COMMON APPROACH FOR PLANETARY HABITATION SYSTEMS IMPLEMENTATION**

FRANK STEINSIEK and UWE APEL 1990 11 p Presented at the 20th International Conference on Environmental Systems, Williamsburg, VA, 9-12 Jul. 1990 Previously announced in IAA as A90-49425 Prepared in cooperation with Erno Raumfahrttechnik G.m.b.H.  
(MBB-UO-0115-90-PUB; ETN-91-98549) Avail: NTIS HC/MF A03

Possible concepts for orbital, lunar and Martian habitations are based on ESA-European Manned Space Infrastructure (EMSI) program philosophy are presented. The key requirements for the design of an orbital habitat were reviewed, such as atmospheric pressure, temperature, radiation and gravity levels. The human factors such as life cycle, ergonomics and psychological needs were examined. A common approach for these three cases may be to use as much available hardware in each step of the scenario as possible. The implementation of the habitation systems offers the possibility to work in an evolutionary way, starting with the EMSI Columbus based hardware. ESA

**SPACE BIOLOGY**

Includes exobiology; planetary biology; and extraterrestrial life.

**N91-15691\*#** National Aeronautics and Space Administration.  
Ames Research Center, Moffett Field, CA.

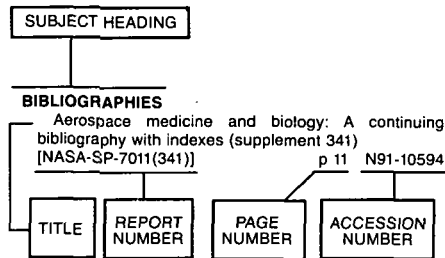
**EXO BIOLOGY ON MARS**

D. L. DEVINCENZI, ed., J. R. MARSHALL, ed., and D. ANDERSEN, ed. Dec. 1990 35 p Proceedings held at Moffett Field, CA, 27-28 Feb. 1989

(NASA-CP-10055; A-90320; NAS 1.55:10055) Avail: NTIS  
HC/MF A03 CSCL 06/3

Descriptions of several instrument concepts that were generated during a workshop entitled, Exobiology Instrument Concepts for a Soviet Mars 94/94 Mission, held at NASA Ames Research Center in 1989 are presented. The objective was to define and describe instrument concepts for exobiology and related science that would be compatible with the mission types under discussion for the 1994 and 1996 Soviet Mars missions. Experiments that use existing technology were emphasized. The concepts discussed could also be used on U.S. missions that follow Mars Observer. Author

## Typical Subject Index Listing



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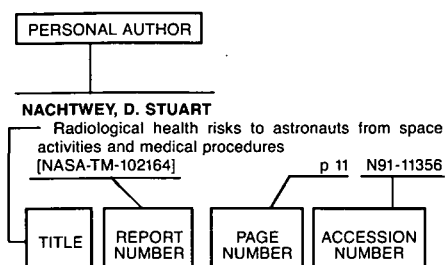
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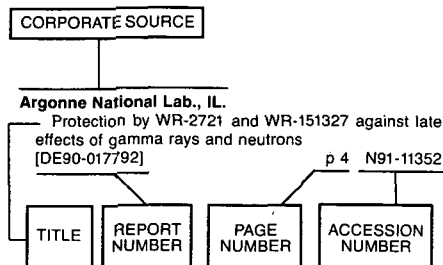
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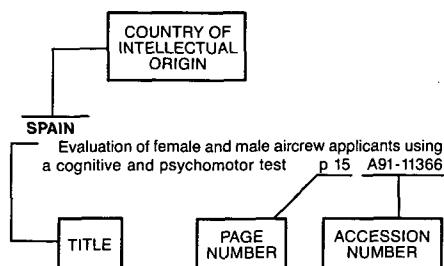
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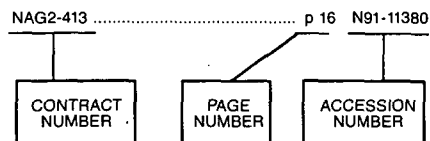


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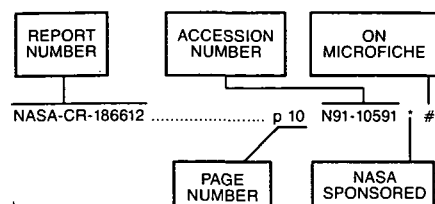
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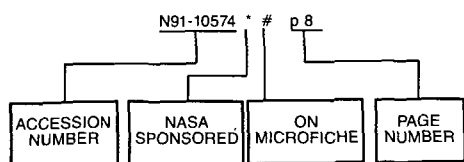
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1. Report No. NASA SP-7011(349)		2. Government Accession No.		3. Recipient's Catalog No.	
4. Title and Subtitle Aerospace Medicine and Biology A Continuing Bibliography (Supplement 349)				5. Report Date May 1991	
				6. Performing Organization Code NTT	
7. Author(s)				8. Performing Organization Report No.	
9. Performing Organization Name and Address NASA Scientific and Technical Information Program				10. Work Unit No.	
				11. Contract or Grant No.	
12. Sponsoring Agency Name and Address National Aeronautics and Space Administration Washington, DC 20546				13. Type of Report and Period Covered Special Publication	
				14. Sponsoring Agency Code	
15. Supplementary Notes					
16. Abstract This bibliography lists 149 reports, articles and other documents introduced into the NASA scientific and technical information system in April 1991.					
17. Key Words (Suggested by Authors(s)) Aerospace Medicine Bibliographies Biological Effects			18. Distribution Statement Unclassified - Unlimited Subject Category - 52		
19. Security Classif. (of this report) Unclassified		20. Security Classif. (of this page) Unclassified		21. No. of Pages 64	
				22. Price * A04/HC	

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